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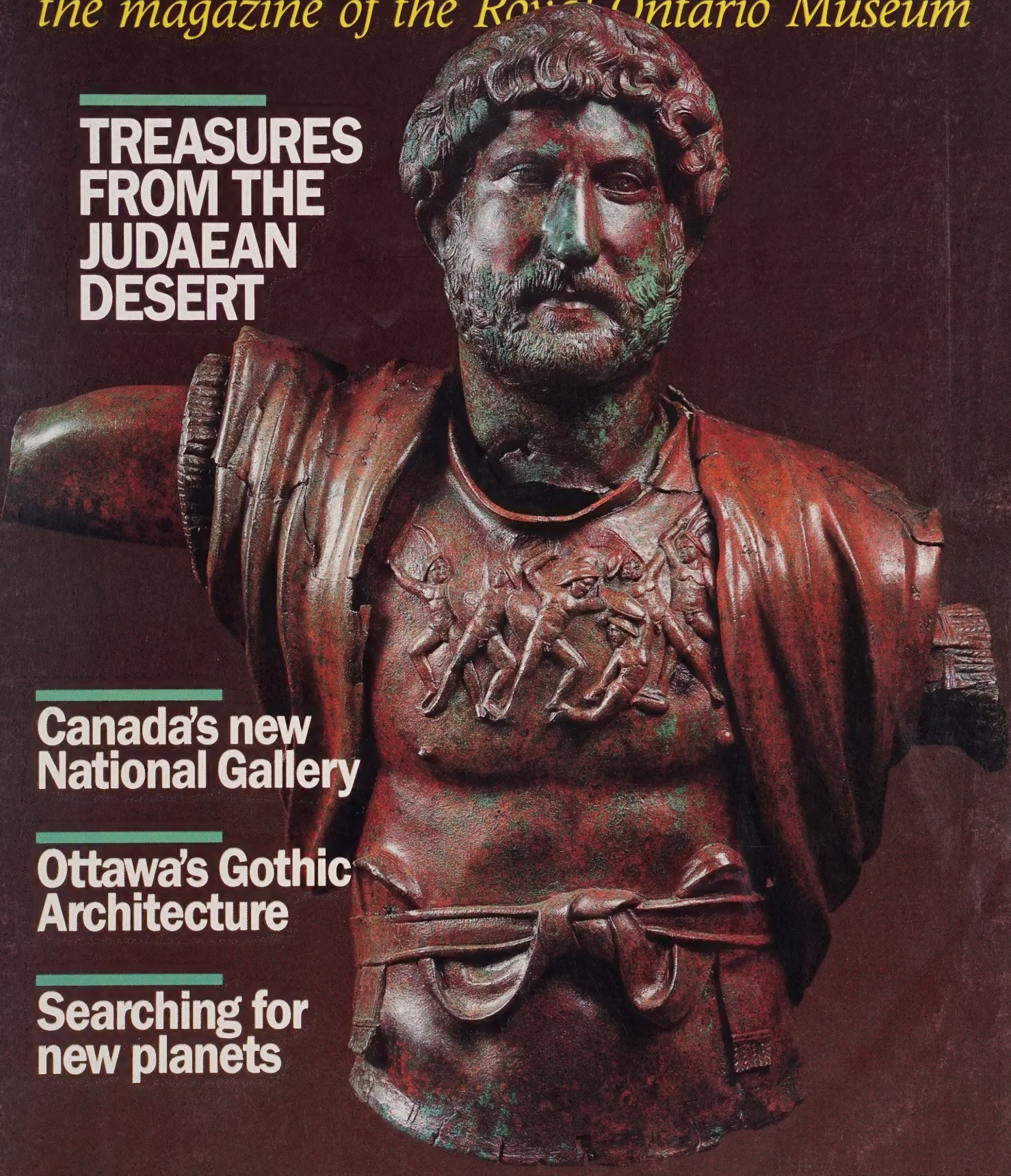
the magazine of the Royal Ontario Museum



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It's really all a mystery

"If only those objects could speak, what stories they would tell." Those of us who work in the ROM find this comment more of a cliché than references to Toronto's cleanliness. Yet I must confess that I found myself repeating that line over and over when I was first told about the Cave of the Treasure, located in the heart of the Judaean Desert.

In this cave, Pessah Bar-Adon, one of Israel's greatest archaeologists, discovered more than four hundred copper masterpieces, dating back almost six thousand years to the Chalcolithic period. This find is as important as that other amazing archaeological windfall, the discovery of the Dead Sea Scrolls. Miriam Tadmor, senior curator at the Israel Museum, recounts the whole story in this issue of *Rotunda* and explains what it means to our understanding of Chalcolithic society.

Some of these objects are on display at the ROM until 5 September as part of the exhibition *Treasures of the Holy Land: Ancient Art from the Israel Museum*, organized by the Metropolitan Museum of Art. This exhibition, which by the way does include three of the Dead Sea Scrolls, displays artifacts that represent eleven thousand years of human history in the Holy Land, from prehistoric times to the fall of the Byzantine Empire.

From the mysteries still guarded by objects that are thousands of years old, we turn to the brand new National Gallery of Canada, where the only mystery is why it took more than a century for our national art treasures to receive a proper home. Architectural historian Geoffrey Simmins describes Moshe Safdie's magnificent building and the rather convoluted events that finally led to its construction. The new building, Safdie's first major Canadian commission since Habitat for Expo '67, is encased in a glass shell, which offers Gallery visitors postcard perfect views of the Parliament Buildings, Notre-Dame Basilica, and the Rideau Canal. The towers marking the entrance are a striking modern tribute to Ottawa's 19th-century Gothic splendour.

This architectural tribute to the Gothic revival brings us to the question of why the revival took place. York University professor Malcolm Thurlby writes that it was mainly because of the popular belief held in Europe and North America that Christian social values had declined during the Industrial Revolution. The classical architecture of the early 19th century was considered to represent this decline, whereas Gothic architecture represented the purer Christianity of the centuries preceding the Revolution. The revival of Gothic-style architecture in Ottawa inspired the construction of such graceful structures as Notre-Dame Basilica and the Parliament Buildings. But did their construction improve the moral standards of our nation's capital? That too, is a mystery.

And finally, for a mystery that is completely out of this world, readers can imagine what it's like to spend a night with Canadian astronomer Bruce Campbell at the Canada-France-Hawaii Telescope, on top of Hawaii's Mauna Kea. Campbell is leading the search for other planets in other solar systems. Science writer Bill Johnstone explains why even without a direct sighting, Campbell believes that he has succeeded.

From ancient artifacts and cultures to Ottawa architecture, and undiscovered solar systems, we hope that you are intrigued by the mysteries that are present in this issue of *Rotunda*.

S.S.

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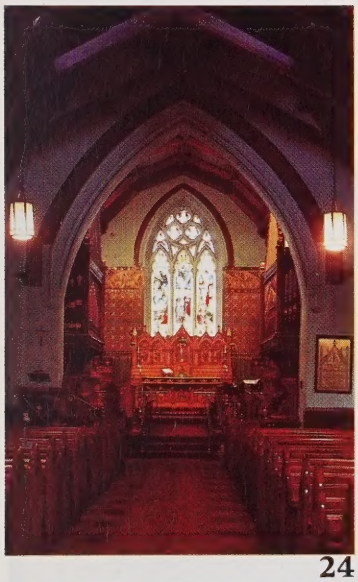

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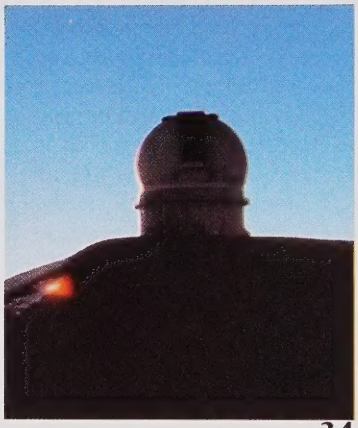
COVER

This bronze statue of Hadrian, part of the collection of the Israel Department of Antiquities and Museums, will be on view at the ROM during the exhibition *Treasures of the Holy Land: Ancient Art from the Israel Museum*, organized by the Metropolitan Museum of Art. For a story about how some of the treasures were found, turn to page 14. Photo by David Harris.



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A first visit to Palestine

In 1945, the war in Europe having just ended, my mother and I sailed from New York to join my father in Iran. We were booked on the Swedish liner *Gripsholm*, a ship that I remember well. She was painted entirely in white, and her name was written in huge letters that stretched in height from the water-line up to the lowest promenade deck and ran the entire length of the hull. The exaggerated size of the lettering had ensured, during the war, that German U-boat captains could see from a great distance, through their periscopes, that they were stalking a Swedish, and therefore neutral, vessel. The ship was terribly overcrowded: this may have been the first post-war sailing for civilians from New York.

As there was still a conflict on in the Pacific, there was always a chance that a Japanese submarine could be loose in the Atlantic. We had blackouts every night and surprise lifeboat drills every day. It was all terribly exciting for an eleven-year-old.

We stopped briefly at Gibraltar before entering the Mediterranean, where our first call was Naples. The Naples harbour had not been cleared of sunken ships and the great sheds alongside the pier where we docked were bombed, twisted masses of concrete and steel; the city was full of Allied troops. A friend, who was about my age, and I were the only ones allowed off the ship. Because we reminded some of the troops of their own sons, whom they had not seen for as many as three or four years, they treated us to a terrific time for the two days that we were in port.

After our stay in Naples we travelled to Piraeus, where no one disembarked, and then on to Haifa, in British Mandate Palestine, where my mother and I disembarked to find my father, who had come to meet us all the way from Tehran. Meanwhile the *Gripsholm* sailed on to Alexandria, its last port of call before returning to Sweden.

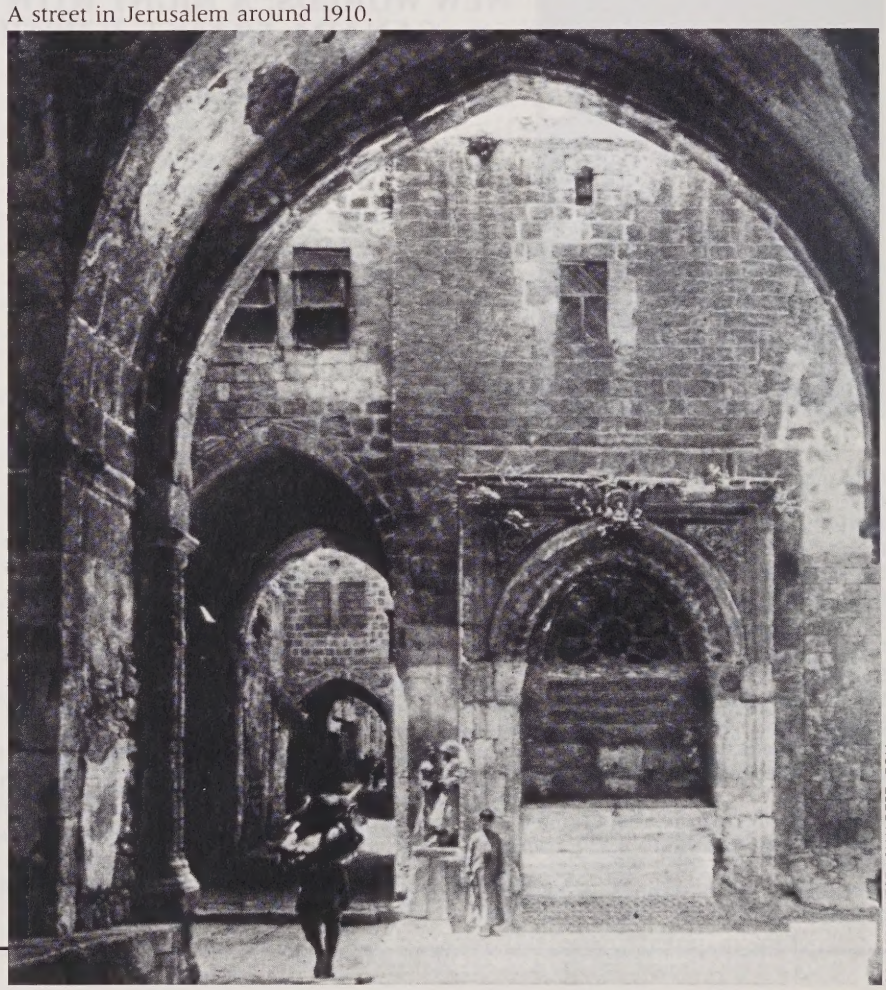
Unfortunately, in New York our checked baggage—and there was a lot of it since we were to be a family of three in Iran for an indefinite period—had been put in the very bottom of the hold, under the baggage destined for Alexandria. It was absolutely impossible to unload our baggage at Haifa. Father and Suren, his Iranian driver, went off to Alexandria to retrieve our belongings, and Mother and I took a room in a small pension in Jerusalem where we would stay until their return, two weeks later. With this turn of events, I had an unexpected and wonderful opportunity, at a fairly young age, to visit and learn about ancient Palestine.

I have, of course, returned to this part of the world several times: briefly once again to Palestine, as well as on various occasions to Israel and Jordan. Yet I've never been able to recapture the wonder, amazement, and romance, or to experience the intellectual growth of that first two-week stay in Palestine.

Through my family I was well acquainted with biblical history, even at the age of eleven, and so I had some frame of reference as Mother and I set out to visit the Dead Sea, Jericho, or Mount Carmel. However, it was our visit to Megiddo that left me with the greatest impression—so great, in fact, that to this day I can reconstruct, in my mind, almost everything we did and saw there.

Father had returned from Egypt and so it was the three of us who drove north from Jerusalem to visit this great site. Megiddo had been under excavation by the Oriental Institute of the University of Chicago when my father was a graduate student at the Institute in the thirties. When we moved to Toronto, my father's senior colleague in Near Eastern Studies at Victoria College

A street in Jerusalem around 1910.



COURTESY WEST ASIAN DEPT., ROM

was the noted Toronto biblical scholar, Bill Staples. Staples had also studied at Chicago and, if I remember correctly, had been on the excavation staff at Megiddo for at least a season if not more. Probably much of what my father knew of the site had been learned through his long talks with Staples.

Be that as it may, Megiddo was and remains one of the remarkable sites of the ancient Near East. It stands at the base of Mount Carmel on the west side of the Plain of Esdraelon, just at the point where the largest and most important pass up from the Mediterranean coast breaks into the plain: one of the most strategic locations in the whole of the Levant. Tuthmosis III, king of Egypt, fought and defeated a Syrian coalition of princes there in the 15th century B.C., and it was before Megiddo, in 1918, that General Allenby routed the Turks and drove them out of Jerusalem and Palestine, a battle that was one of the few bits of tactical brilliance in that whole, miserable war. The final battle of earthly history, Armageddon, is also supposed to be fought there.

The site was occupied for several millennia, but for a boy of eleven, the most exciting settlement dated to the days of the kings of Israel, especially Solomon. At Megiddo the wise son of David built a great royal stable to house his horses and chariots—the backbone of the royal armies. The site was heavily fortified with a casemate wall, a double gate, and a remarkable water system. In time of siege, maintaining a supply of water is always the biggest problem for the defenders. The solution at Megiddo was to dig, from inside the fortress, a stepped tunnel through the living rock deep down to an underground pool, which was below an area just outside the city walls. Niches were hollowed into the sides of the tunnel at key locations in order to provide sentry boxes for soldiers, who would thwart any attempt by the enemy to enter the city by way of the shaft. The discovery and excavation of this remarkable bit of ancient engineering were among the

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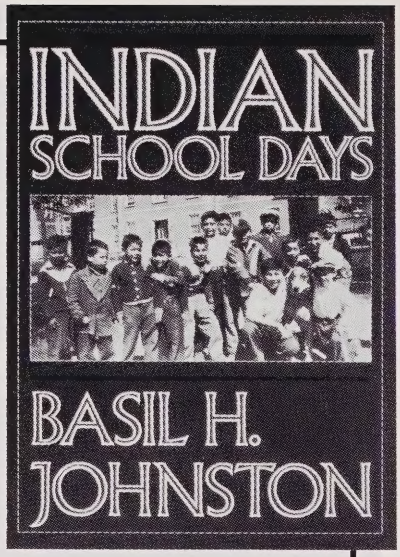

Indian School Days is the humorous, bittersweet autobiography of Basil Johnston, a native Ojibway who was taken from his family at age 10 and placed in a "residential" school in northern Ontario.

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highlights of archaeological work at Megiddo.

I was told the story about the excavators finding the sentries' pottery oil lamps in some of the niches, together with the skeleton of one sentry. Apparently during an attack on the city via the tunnel, this sentry had been caught napping at his post. Seeing this shaft is what made me decide to become an archaeologist.

This is the kind of romance inherent in the archaeology of the region and it is well conveyed in the exhibition "Treasures of the Holy Land: Ancient Art from the Israel Museum," organized by the Metropolitan Museum of Art in New York. The exhibition opened a few days ago at the ROM. It is a show that provides the visitor with a complete introduction to the archaeology of what is still professionally referred to as Palestine—from Epi-palaeolithic through to Byzantine times—almost eleven thousand years of history. Outstanding objects of great beauty have been chosen from a wealth of material. I suspect that visitors to the exhibition, whether or not they have been to the Holy Land, will experience what I did during my first visit.

And let us not forget Solomon. The Holy Land is the birthplace of the Judaeo-Christian tradition. While the show is about the archaeology of the Holy Land, and thus tells a story that includes more than its religious traditions, the biblical and pagan connections are definitely there.

"Treasures of the Holy Land: Ancient Art from the Israel Museum," continues through August at the ROM. It should be visited for a learning experience in archaeology and history, for an aesthetic experience involving ancient objects of great beauty, for a glimpse at some of the world's religious roots, and for the romance of it all. And if you know any eleven-year-olds, bring them along. From personal experience I guarantee they will be captivated.

T. CUYLER YOUNG, JR.

Saving the Sumatran elephant

STEPHEN V. NASH

A Sumatran elephant looks out warily from his forest habitat in the Padang-Sugihan Wildlife Reserve.

When we arrived at the Padang-Sugihan Wildlife Reserve in Indonesia's South Sumatra Province in August 1984, we were faced with the task of determining if the new and uniquely large population of Sumatran elephants could be supported and contained in the reserve. Our work was complicated because we were dealing with an animal rarely encountered, and whose ecology and habits were therefore little known.

The reserve was established to solve the problems arising from the conversion of large areas of swamp forest to agricultural land for settlers from Java. Elephants found their forest habitat greatly reduced by the land-clearing program but the crops planted by the settlers—sugar cane, pineapples, papaya, rice, and so on—were foods favoured by the great animals. Groups of Sumatran elephants plagued the first settlers, in particular those of the Sugihan River area, by raiding their agricultural plots by night, retreating to remnant patches of forest cover by day.

To resolve this conflict, the government of Indonesia planned a massive elephant drive, code-named Ganesha, to round up the elephants and to drive them into the still-forested portion of the lands. This forest would then be designated as an elephant reserve.

Unlike its mainland cousins in Asia, the Sumatran elephant is a deep-forest-living animal that usually will leave the cover of the dense forest only at night, if at all. By nature the Sumatran race of elephants is very wary, and it is smaller in stature and hairier than the mainland races. At the best present estimate, some 2800 Sumatran elephants survive in the wild, though ten years ago the estimate was only 350 animals. The difference is not due to a natural increase; with the cutting of forests and subsequent loss of elephant habitat, pockets of previously unknown animals have been found.

When the government prepared its Ganesha drive, about 80 individuals were expected to be driven into a 750-square-kilometre patch of riverine swamp forest, paperbark forest, peatswamp forest, and open grassland. The drive, carried out in 1982, was successful, but to everyone's surprise, 232 elephants emerged. They were driven into the alloted lands, which probably already supported an elephant population. In April of 1983 the forest was given legal status as the Padang-Sugihan Wildlife Reserve, and the government's Directorate General of Forest Protection and Nature Conservation requested that the World Wildlife Fund carry out an ecological study.

To reach Padang-Sugihan we travelled from the city of Palembang along the 95-kilometre river route in a borrowed government boat. At the reserve we moved into a vacant tin-roofed house adjacent to the headquarters building, and set up a workable field station. A routine was established very quickly. During the first days of each month we walked a measured 30 kilometres of riverbanks, streambanks, and trails, looking for elephant groups or signs; mostly we found tracks, dung piles, and evidence of feeding. For the rest of the month we chose areas at random or followed up reported sightings. Travel within the reserve was made easier by the presence of a man-made canal system, originally dug when the area was being prepared for settlers. We were provided with a five-metre riverboat with a five-horsepower inboard engine for the duration of the study.

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Over a period of fourteen months, we were able to find out a great deal about the elephants' adaptation to life in a restricted habitat. The elephants were unevenly clustered, with a large herd of 80 to 100 in the northern third of the reserve, while the remaining 150 or so were scattered in groups of 2 to 20, together with some lone bulls, in the other two-thirds. The smaller groups and the single males ranged widely, but the large herd never travelled outside their northern corner. Certain forest patches in the southern portion of the reserve were rich in favoured foods, but oddly enough these areas were avoided by the smaller groups. The various habitat types are quite evenly distributed throughout the reserve, and so we expected to find a more homogeneous distribution of elephants, mostly in small social groups. The clumped distribution was definitely a sign of trouble.

Elephants are very demanding in terms of food and space, and it would stand to reason that to survive in the artificially high population density of Padang-Sugihan, small groups would have to spread out over the whole area, thereby imposing the least strain on the reserve's resources. Elephants overbrowsing an area beyond its ability to regenerate would have to move either to parts of the reserve already occupied by other elephants, or outside the reserve to feed in croplands. Therefore we were greatly concerned about the overcrowding by the large herd. Throughout the study, the herd was observed eating everything in sight in an available habitat, and then moving on to the next habitat. All the elephants we saw were thin; they were finding enough to live on, but that was all. In some of the northern areas we also found evidence of slow degredation: the vegetation was not quite growing back in time for return visits by the elephants. As it turned out, the problem was that the elephants were victims of their own shyness.

The large herd was contained not by a physical barrier but by a psychological one caused by the frequent riverboat traffic along one of the irrigation canals. The 15-kilometre canal is the only one that fully connected the Padang and Sugihan rivers, and people travelling among the scattered communities on both rivers used it as a short-cut. Small groups of elephants regularly crossed the soft-bottomed canal with ease, but the large herd would not, perhaps because of young calves that were unwilling to make the crossing. To the south, widespread illegal logging operations within the reserve boundaries were harassing elephants, forcing them to avoid large forest patches and the foods they contained. Clearly, managing Padang-Sugihan as an elephant sanctuary meant prohibiting people in the reserve.

We finished our work at Padang-Sugihan by recommending that the entrances to all the canals be blocked off to boat traffic, and that the removal of cut logs from inside the reserve be made impossible. All areas of the reserve would become easily accessible to elephants and hopefully this would encourage the large herd to break up and scatter. This in turn should reduce the possibility of overbrowsing. By the time we left Padang-Sugihan, the government had started to implement the plan, and to increase guard patrols along the reserve boundaries.

With the active protection of the elephants, a great many other wildlife species are assured a place to live. Within Padang-Sugihan there are more than two hundred species of birds, including the extremely rare white-winged wood duck and the Storm's stork. The reserve supports populations of Sumatran tigers, fishing cats, sun bears, otters and otter-civets, pigs, mouse deer, gibbons, and leaf-monkeys to name but a few. Yet for all its animal richness, Padang-Sugihan will be known for its elephants, the largest single group of Sumatran elephants to be found anywhere.

STEPHEN V. NASH
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This pair of Chelsea "Hans Sloane" plates, circa 1755,
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The universal alliums

The market of Chalons-Sur-Marne in the Champagne region of France displays an appetizing selection of onions and garlic.

Whoever dubbed garlic "the stinking rose" got it mostly wrong. Garlic is no relative of the rose. Along with its sister alliums, it's a member of the lily family, quite a different basket of flowers. Hardy, bulbous plants with straplike or tubular leaves, flower heads in globes or umbels, and, yes, a certain pungent perfume, the alliums have been relished by much of humankind seemingly forever. When the Children of Israel followed Moses into the wilderness, they cried not only for the "fish, which we did eat in Egypt freely; the cucumbers, and the melons," but also for "the leeks, and the onions, and the garlic."

The best-known members of the clan, besides these three, are scallions or green onions, shallots, and chives, but there are some three hundred others, both edible and decorative. Some are exotic: rocambole, the serpent garlic, twines its stalk into a snakelike swirl, topped by a head of bulbils. Others are comical: the Egyptian or walking onion also develops clusters of bulbs on its stalk, but it topples over under their weight to root and start new plants. Others are as homely as wild leeks, also known as ramps or ramsons, whose sharp flavour makes such a welcome addition to spring soups.

The alliums' point of origin is credited variously to the Middle East, Siberia, other parts of Asia, the Mediterranean basin, and North America. Today wild species thrive throughout the temperate zones, while cultivated varieties flourish in farms and gardens around the world. Certainly most cooks cherish the edible alliums. One or another appears near the top of every "favourite seasonings" list I've ever seen. Trying to prepare food without them is an exercise in frustration for, in recipes, alliums are everywhere.

However, this doesn't mean that absolutely *everyone* loves them. For some, onions and their ilk seem difficult to digest. For others, the distinctive scent is so unacceptable that they won't risk trying more than a nibble. That famed 19th-century arbiter of household standards, Mrs. Beeton, warned that even the relatively mild leek must be "well-boiled"—by which she no doubt meant overcooked—else it will "taint the breath," and her advice would still be considered prudent by many today. Perhaps she should have resorted to some of the folk remedies practised where alliums form a major part of the diet: eating lots of green herbs, particularly parsley, along with raw onions or garlic is thought to be an antidote; chewing aromatic seeds—coriander, for example—can also sweeten the breath; and simple cooking tames the substances responsible for undesirable fumes. Alliums needn't be boiled to death.

Those fumes, according to Janet Bailey, author of *Keeping Food Fresh*, occur because the enzymes that are aroused when an onion is cut interact with a passive sulphur compound within the onion's cells thereby creating volatile acids and ammonia, which are irritants. Science writer Carol Ann Rinzler, in *The Complete Book of Food*, further explains that some of the sulphur compound also floats up into the air from the cut onion, and turns into sulphuric acid when it comes into contact with water. No wonder this stings when it gets into our eyes. Several sources suggest counteracting the problem by refrigerating onions for an hour beforehand or slicing them under running water. Even more effective, I've found, is donning a pair of ski goggles. Safe behind them, you can slice to your heart's content and not risk contaminating the milk or washing your chopped onion down the drain.

Cooking aside, there are many other uses for alliums. Purely decorative varieties like *Allium moly*, the golden garlic, or *Allium albopilosum*, literally "white shaggy onion," delight gardeners with colourful blooms in shades of rosy lavender, bright yellow, sky blue, and crisp white, borne on stout stems that range in height from a few centimetres to more than two metres. Their culinary cousins aid in

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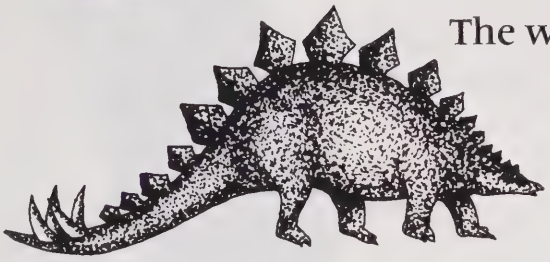

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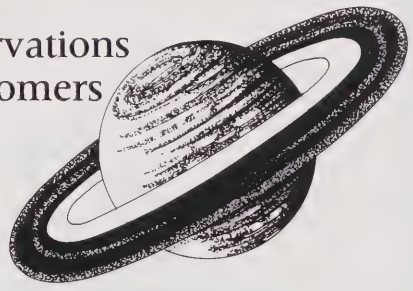

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repelling garden pests, either by being crushed or ground into sprays or by companion planting. While it's difficult to prove the benefits of the latter practice, some seasoned gardeners swear that a clump of chives improves the growth and flavour of carrots nearby, and that garlic planted beside roses and raspberries deters the dread Japanese beetle and also improves the plants' health.

One can't discuss the merits of alliums without reference to vampires, whose aversion to garlic is well known, and evil spirits, who will steer clear of houses with garlic hung by the door. Next to garlic, an onion seems to be the most useful allium when it comes to matters supernatural. Carry one in your pocket to protect against venomous beasts, or stick a small white one full of blackheaded pins and set it on a windowsill to keep evil from entering. Folklore has it that people eating leeks together will fall in love, which may call for precautions at certain dinner parties. Finally, you may wish to float shallots in bath water to wash away misfortune (though whether the shallot scent can be counteracted by fragrant soap or bubble bath, the oracles don't say).

Folk wisdom also stresses the healthful properties of onions, garlic, and their kin, and here the story-tellers are on firmer ground. Both garlic and onions have antiseptic properties. A small amount of garlic juice mixed with hot water or honey may ease a sore throat, while a crushed raw garlic clove or a slice of onion can soothe an insect bite. Garlic and green onions are also rich in vitamins and minerals. For example, 28 g of green onions, tops and bulbs, contain about 12 mg of vitamin C, one-fifth of the recommended adult daily dose, while 28 g of raw garlic contains about 9 mg, perhaps not enough to supercede the breakfast orange juice, but certainly a significant source as long as you're living and working with others who share your healthy tastes.

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The Judaean Desert Treasure

Archaeologists were stunned by the chance discovery of a hoard of copper masterpieces

Miriam Tadmor

A great discovery may suddenly illuminate a region that until then was of little importance or interest. Such was the case when the discovery of the Dead Sea Scrolls was first revealed and their origins traced to the Judaean Desert, a narrow stretch of land which frames the Dead Sea in the east and reaches the very limits of Jerusalem in the west. The Judaean Desert is a forbidding region: mountainous, arid, and of extreme temperatures. Its peculiar geological structure of chalk and limestone rock contributed to the formation of numerous riverbeds, which traverse the desert from west to east, becoming steep canyons; it was also conducive to the formation of natural caves, often multi-chambered and deep.

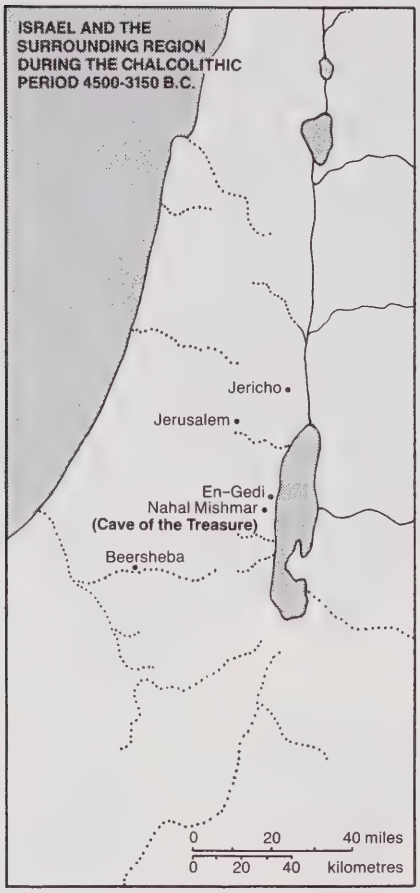
Settlement in this region has been precluded by the combination of geographical and climatic conditions and has only been possible near the few perennial springs. For instance, man has lived near the Jericho springs from time immemorial and the oasis at En-Gedi has served a community at various periods in history. Otherwise, so it seemed, the desert was the domain of fugitives and the birth-place of monasticism.

In 1947 the first Dead Sea Scrolls were offered to the Hebrew University; more were acquired later. They are all now displayed in the Shrine of the Book in the Israel Museum. The site of Khirbet Qumran and the surrounding caves at the northeastern edge of the Dead Sea were excavated during several seasons from 1949. Hundreds of scroll fragments and complete manuscripts were found in these excavations, as well as the remains of a large community centre, commonly associated with Essenes—the sect of the Dead Sea Scrolls, which flourished at Qumran on the shores of the Dead Sea from the 2nd century B.C. until the fall of Jerusalem and Masada in A.D. 70.

DAVID HARRIS

Above: This exquisite copper mace head (height: 11 cm) is one of more than 400 artifacts from the Cave of the Treasure. Collection of the Israel Department of Antiquities and Museums.
Facing page: Pessah Bar-Adon looks at the copper treasures and the reed mat that covered them.

In 1960–61 a joint expedition was formed by the Hebrew University, the Israel Exploration Society, and the Department of Antiquities, with the aim of surveying and, when necessary, excavating the Judaean Desert between Masada and En-Gedi. The preliminary survey of various caves along these valleys almost invariably revealed finds of the Roman and Chalcolithic periods. Finally, it was decided to concentrate efforts on one of the surveyed caves. Situated on the north bank of Nahal Mishmar, it was then named the "Scouts Cave." Bar-Adon, the leader of the expedition, was one of archaeology's more colourful personalities, renowned for his endurance and perseverance. The story of this excavation has become part of the saga of modern archaeological research in Israel.



Facing page: It is no wonder that the Cave of the Treasure guarded its secret hoard for almost 6000 years. The only way to reach the cave, located about 50 metres below the top of a canyon in the heart of the Judaean Desert, was by climbing down a rope ladder. One false step would have meant a fall of 250 metres to the canyon floor. Members of the expedition then had to remove the heavy boulders that blocked the cave's entrance.

The cave lies approximately 50 metres below the top of the canyon, with a sheer drop of about 250 metres to the floor of the canyon, and it is impossible to reach without the help of rope ladders. It is a large cave with two halls, penetrating some 14 metres into the rock, but there are also tunnels and crevices that can only be explored by crawling. The cave was blocked by large fallen rocks and was littered with bird droppings. These had to be cleared away and the surfaces cleaned; work was dangerous and progress was slow.

Two layers of occupation were discovered in the cave: the upper was from the Roman period dating to the Bar Kokhba revolt against the Romans in A.D. 132–135; the lower level was Chalcolithic, of the 4th millennium B.C. There was also a thin intermediate layer, the accumulation of thousands of years.

In the Chalcolithic layer potsherds, linen cloth, leather artifacts, basketry, food remains, parts of a wooden loom, and spinning and weaving tools were found. A hearth was revealed in the first hall, with pottery, a straw sieve, and a large quantity of non-carbonized grains of wheat and barley nearby. There were five human burials in this cave and a few more in the Chalcolithic levels of adjoining caves. Obviously, people had lived there for some time.

But the discoveries of the first and second seasons (1960 and 1961) were rather disappointing until 21 March 1961. It was then that two volunteers who were working in the first hall of the cave reached into a crevice that had been sealed by a stone and brought out some strange copper artifacts. A few more hours of work were needed to remove many more artifacts from their hiding place and to expose and remove the reed mat in which they had been wrapped.

Pessah Bar-Adon, in his account of the excavation, published some years later, described their reaction: "We stood thrilled and excited at the sight of the growing heap of objects, whose number and quality, strangeness and beauty of design aroused our wonder and admiration. . . . Most of the artifacts . . . were of completely unknown types, which had never been found before, either in [Israel] or elsewhere." The Scouts Cave was appropriately renamed The Cave of the Treasure.

Something of that surprise—almost disbelief—which overtook the excavators on the day of discovery is still felt by those who see the treasure for the first time as well as by those who know it intimately and try to solve its riddle. There in the desert cave was a find that seemed utterly out of place for its time. A product of a pre-literate society, it speaks a language we can hardly comprehend, but it forces us to change some of our accepted views on human development in the Chalcolithic period and on the history of early metallurgy.

This truly remarkable hoard is exhibited in its entirety at the Israel Museum. It contains almost 430 artifacts, all but a few made of copper. The largest group—almost 240 items—comprises maceheads, mostly globular or pear-shaped. There are some 80 elongated objects, hollowed lengthwise. These have been described as standards, but a preferable description is ornate maces—symbols of power and status. In some there were still remains of the wooden poles on which the maces were carried. It is not known how 10 heavy rings, which to our modern eyes resemble crowns, were used. There are sceptres, each with its own design, that differ from the maces not only in their length but also in the fact that their shafts are solid rather than hollow.

All of these would have been ceremonial or cult objects rather than functional. Neither the maces nor the mace heads could have been used in combat against an enemy: they were produced by complex technical processes, using costly raw material, and many have no real mechanical strength. Other copper artifacts include a few copper pots, three horn-shaped objects, which once were hung by rope, and a group of tools, axes, and adzes.

A limestone mace head and 6 mace heads made of hematite are some of the non-copper treasures. There are also 6 ivory objects of enigmatic shape; 5 made from horizontal segments of sturdy hippopotamus tusks that have been perforated all over, a truly remarkable technical achievement of an expert

ivory cutter who lived almost six thousand years ago. The sixth is an elongated hollow container of elephant ivory, with a flat base and beautifully smooth thin walls.

The decorative schemes on the artifacts are as fascinating as their shapes. They comprise mainly abstract motifs in an endless variety of horizontal, vertical, and zig-zag lines in sunken or raised relief. There are also knobs and bosses and a variety of protrusions in various arrangements.

Representational motifs consist mostly of zoomorphic elements, often the heads of horned animals; straight, horizontally grooved ibex horns, naturalistically portrayed, are widely used as ornaments in maces and they appear also in crowns. The depiction of entire animals is extremely rare. Even in an ornate mace surmounted by horned animals, the arrangement is abstract and symbolic rather than naturalistic: not a representation of two animals but instead two heads and four legs joined to one flat body, like Siamese twins. Birds, naturalistically depicted, are perched on the rim of a "crown." However, a very stylized vulture is schematically portrayed as a flat plaque topped by a naturalistically rendered head in the round, with details of the tail and wings indicated by linear ornaments.

Human heads are portrayed on only two objects. Produced in a rather sketchy manner, the surface of a "crown" is decorated by two incised round eyes and a boldly projecting nose. In contrast, a very clear representation of eyes and a nose are found on one of the mace heads. In fact, one wonders if the whole mace should be viewed as a highly schematic totemlike human figure.

Even to the modern eye the designs of the objects seem highly sophisticated and hauntingly attractive. But it is the use of advanced technology for the creation of these objects that has made the copper treasure a truly revolutionary discovery. Modern scholars envisaged the transition from stone to metal technology as a gradual process that took place during the 4th millennium B.C., in the Chalcolithic period. However, the Judaean Desert copper hoard makes it clear that by the 4th millennium, the processes of melting, casting, and finishing had been already mastered.

Who were the ancient coppersmiths? Where was the treasure produced? How was it used? There are no easy or clear answers to these questions. But the enigma that seemed so complete in 1961, upon the discovery of the treasure, is being very slowly but persistently unravelled.

Twenty-five years of archaeological discovery have made clear one very important fact. It seems quite certain that the copper treasure was part of the Chalcolithic culture, which to date finds its best documentation in northern Negev sites along the Beersheba River. The Beersheba sites excavated in the 1950s produced similar copper sceptres and mace heads. More have been found in the excavations of Shiqmim in the 1980s, further west along the Beersheba River. And recently a small hoard of such artifacts was unearthed, again near Beersheba. There are only a few at each site—never a hoard of hundreds of objects—but they tie the desert treasure in a firm way to the local Chalcolithic milieu. This is a very important step towards the understanding of the treasure.

It has been suggested that this hoard was the ritual equipment of the nearby sanctuary of En-Gedi and that it was removed in time of danger. However, no similar objects have been found at En-Gedi. Therefore, though attractive, this supposition can not be substantiated. However, the ceremonial designation of such costly, seemingly unfunctional objects remains unquestionable, even if the nature of the cult cannot yet be ascertained.

Nor is it known where the treasure was produced. No one has discovered a centre or centres of copper production in which these objects could have been cast nor have moulds been found. Each of the maces, standards, and sceptres was cast in an individual mould; each one is different.

The source of the ores is also unknown. Many of the artifacts are made of arsenical copper, a type of material that was used in early metallurgy in the ancient Near East. In form and sophistication of technology, they are the most

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DAVID HARRIS COURTESY ISRAEL MUSEUM

Left: This copper, vulture standard (length: 15.3 cm) is the only bird-shaped object from the treasure. It must have appeared to soar when it was mounted on a wooden staff and carried high. Collection of the Israel Department of Antiquities and Museums.
Above left: Copper "crown"; height: 17.5 cm. Collection of the Israel Department of Antiquities and Museums.
Above right: On this copper sceptre (length: 27.5 cm), the animals with the straight horns are ibexes, and the one with twisted horns is a primitive domesticated goat. Collection of the Israel Department of Antiquities and Museums.

Top: Ornate copper sceptres.
Bottom: A perforated hippopotamus tusk *(left)*, made by an expert carver about 6000 years ago, and copper mace heads *(right)*.
All of the artifacts are in the collection of the Israel Department of Antiquities and Museums.

COURTESY ISRAEL MUSEUM

elaborate objects ever found dating from this time. They also represent the greatest quantity of such objects ever found in one place.

The coppersmiths who produced the treasure used the artistic language that was prevalent in contemporary Chalcolithic art in ancient Israel. The zoomorphic and anthropomorphic images that we find in the treasure were presented also in ivory, stone, and ceramic sculpture of that period. It was the language of the Chalcolithic artists, whose ethnic identity escapes us, but whose products are among the finest in the archaeological sequence of ancient Israel. This local culture and its art have specific characteristics that distinguish them from other known cultures of the ancient Near East. We may therefore assume, with a growing measure of certainty, that the treasure was locally produced.

The Judaean Desert treasure is an outstanding example of the ability of the Chalcolithic artisan-smiths. But artisans in Chalcolithic society produced high quality work in other media as well, and so craft specialization must be counted as one of the characteristics of this society; a livelihood, subject to social stratification. Trade must be added to the professions because the costly and sometimes exotic raw materials and finished products must have been transported from both near and far.

Chalcolithic society, which flourished almost six thousand year ago, was one embracing a variety of professions and trades. This can be surmised from finds in the Negev, the Golan, and the Judaean Desert. The Judaean Desert copper treasure should be considered the most accomplished, if still enigmatic, expression of this society. ❦

Miriam Tadmor is senior curator of the Chalcolithic and Canaanite periods at the Israel Museum and its curator of the exhibition Treasures of the Holy Land: Ancient Art from the Israel Museum.

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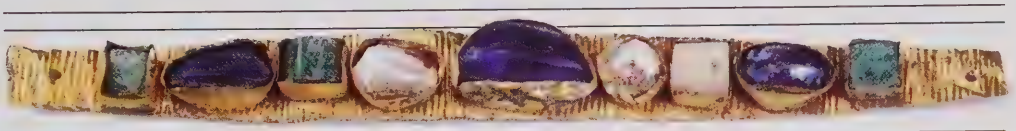

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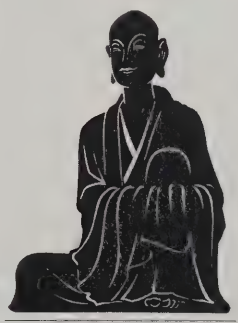

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Ottawa Gothic

The 19th-century revival of Gothic-style architecture began as a comment on the morals of modern society

Malcolm Thurlby

BETWEEN 1140 and 1144, under the patronage of Abbot Suger, the chevet of the abbey church of Saint-Denis was rebuilt and with it a new architectural style was created. Instead of conforming to the current Romanesque manner of building in which the emphasis was on massive forms and mural surfaces, Suger's Gothic chevet appeared skeletal; slim columns, deep buttresses, and pointed arches created the frame for large stained glass windows through which the coloured light would filter to create an illusion of the Heavenly Jerusalem. The new Gothic style immediately became the norm for major church buildings in the Parisian region and the north of France, and by the 13th century Gothic had spread throughout Europe. During the Renaissance in Italy in the 15th century, however, Gothic was replaced with an architecture based on Graeco-Roman antiquity. This approach to architecture also spread throughout Europe with the result that by the 17th century, the Gothic style was essentially a spent force.

Seven hundred years after the start of the Gothic chevet of Saint-Denis, construction was underway on Notre-Dame Basilica in Ottawa, the work being carried out by the local builder, Antoine Robillard to the designs of Father Cannon. Father Cannon conformed to the fashionable neoclassical vocabulary for the detailing of his building as is evident in the Doric pilasters and the entablature framing the west doorways, and in the emphasized quoins of the towers. In 1844, when the Oblate Fathers took over, Gothic replaced neoclassical design at Notre-Dame—pointed rather than round-headed arches were used and tracery was introduced into the windows. Notre-Dame became the cathedral in 1848, but the building was not finished by that date: the twin western towers and spires were completed in 1858, in 1862 the choir was built at the east end, and by 1878 the interior was taking on its present form under the direction of Canon Georges Bouillon. As it stands today, Notre-Dame is a Gothic building in the tradition of Saint-Denis. But why was the initial neoclassical design changed? Why was a style in which the Roman detailing suggested a direct link with the centre of the Catholic church abandoned? Perhaps Father Telmon, who had come from France to design the Gothic church for the Oblate Fathers, chose Gothic as a reminder of France. But if the case was as straightforward as that, then what is the explanation for the use of the Gothic style for the major churches of all denominations in Ottawa built after Notre-Dame? Why were the Parliament Buildings built with a Gothic design? Why was Gothic style chosen for some educational institutions, public buildings, and houses in the city?

The success of the revived Gothic style in the 19th century is due, to a large extent, to the drive of one man, Augustus Welby Pugin (1812–52). Pugin's

Facing page: Ottawa's Notre-Dame Basilica was the first church in that city to be built in the Gothic tradition of the 12th-century abbey church of Saint-Denis.

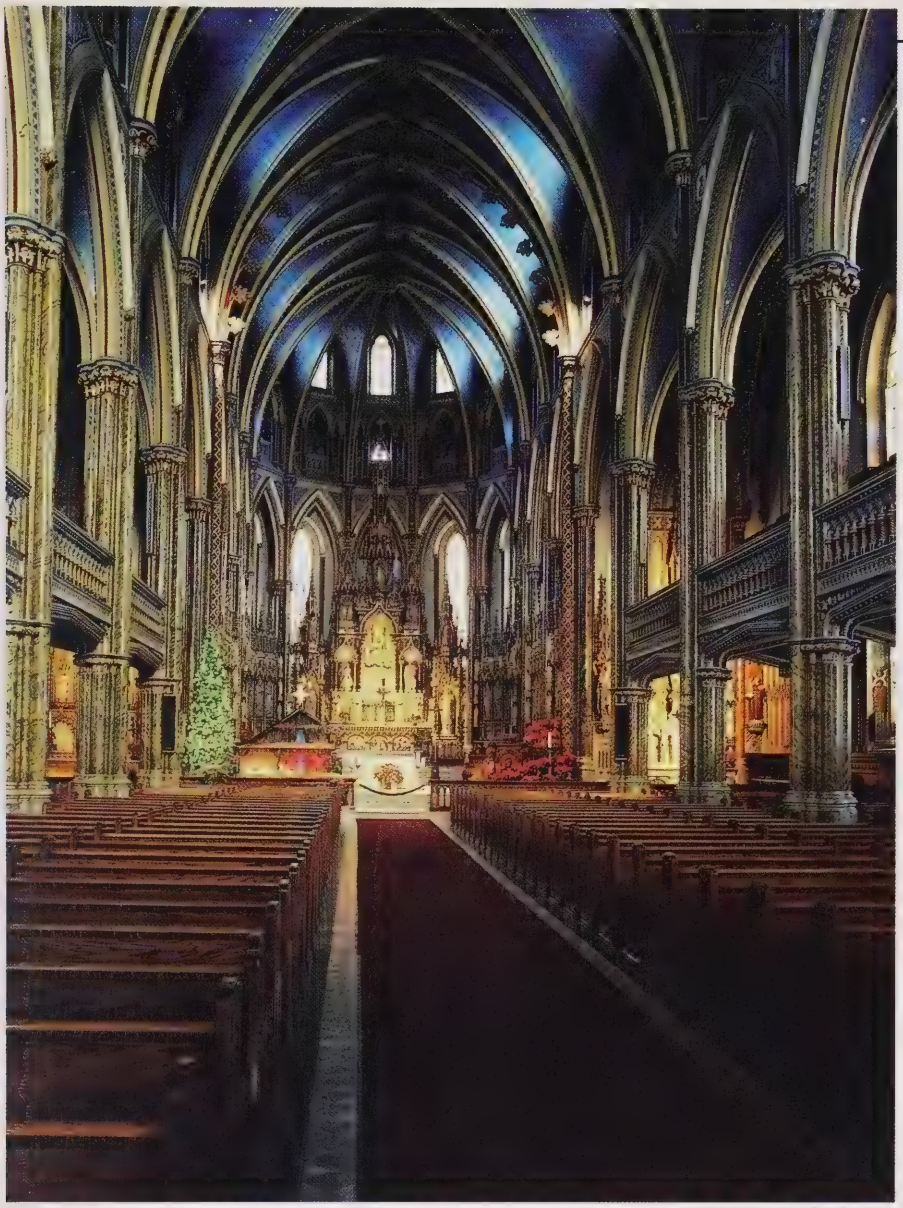
PHOTOGRAPHY BY MALCOLM THURLBY

views were initially expressed in his book entitled *Contrasts: Or a Parallel Between the Noble Edifices of the Fourteenth and Fifteenth Centuries, and Similar Buildings of the Present Day: shewing the Present Decay of Taste: Accompanied by appropriate text,* which was privately published by the author in 1836. As the title suggests, the book was intended to make its initial impact through the illustrations; the pictorial thesis is then reinforced by the polemics of the text.

In the first drawing a town of the medieval period is dominated by the spires of churches; centuries later the modern town is dominated by factory chimneys and warehouses. The details of the two views expand upon the meaning and significance of this juxtaposition. In the modern town, for example, Saint Marie's Abbey has fallen into ruin and an ironworks now occupies the former site of the monastic offices. Warehouses have replaced trees along the riverbank, a prison has replaced the playing field in the foreground, and the bridge across the river, which used to be free, is now blocked by a toll gate. From the aesthetic standpoint there can be no doubt that the image of the medieval town has a greater appeal.

For Pugin's case it is particularly significant that the structures added in modern times to the once medieval town conform to a classical aesthetic. Pugin, a convert to Catholicism, was an unbending advocate of the Gothic style, not just as a matter of taste or fashion but rather because of his belief that classicism reflected paganism, while Catholic Christianity was symbolized by Gothic. He argued that the introduction of Protestantism to England in the 16th century under Henry VIII had been possible only because of a decline in the Roman Catholic church which brought with it a decline in Christian social values. Along with Protestantism came the introduction of the architectural classicism of the Renaissance, classicism that reached its apogee in the early

The success of the revival of Gothic-style architecture is most often attributed to Augustus Welby Pugin. In his book *Contrasts,* he compared the appearance of a town during the medieval period *(top)*, when the architectural style was predominently Gothic, and several centuries later *(bottom)*, when the architectural style was more classical. His conclusion was that the modern town reflected a decline in Christian social values.



The interior of Notre-Dame Basilica, Ottawa.

19th century to coincide, in Pugin's view, with a peak in social problems. Thus Protestantism, classicism, and social problems went together in the same way as Catholicism, Gothic, and good society. To return to the Gothic manner of building would therefore represent, according to Pugin's romantic equation, a return to the Christian social values of the Middle Ages.

Although Pugin cannot be credited directly with the use of Gothic at Notre-Dame Basilica, the impact of his theories was already felt in Canada. In 1842 Father Quiblier, Head of the Congregation of Saint-Sulpice in Montreal, wrote a letter to Pugin asking for his advice on the plan of the church of Saint Patrick, Montreal, for which construction was about to begin. Pugin strongly advocated the use of tall spires to mark the church in the community. The use of twin towers for the façade of Notre-Dame introduced cathedral grandeur to the building thereby setting it above the status of a parish church. Similarly, the inclusion inside of a triforium (the arcaded passage above the main arcade and below the clerestory windows) immediately suggests a cathedral.

Pugin would undoubtedly have objected to the use of imitative materials at Notre-Dame, such as wooden columns painted like marble, or the lath-and-plaster rib vault, while the use of galleries above the aisles would have been an unacceptable hangover from Protestant church design. For Pugin truth to material was an essential of Gothic design. However, in practice compromise between patron and architect, cost considerations, and the availability of

From top to bottom: The exteriors of Saint Alban the Martyr, Ottawa; Saint Bartholomew, Ottawa; and Christ Church Anglican Cathedral, Ottawa.

craftsmen led to deviations from the strict principle; Pugin's son, Edward Welby Pugin, for example, also employed imitative materials in some of his churches.

The Gothic style was also recommended for Anglican churches, and in this case the cause was championed in England by a group of Cambridge undergraduates who constituted the Camden Society in 1839, renamed the Ecclesiological Society in 1846. Their views were expressed in pamphlets such as *A Few Words to Church Builders,* and *The Ecclesiologist,* a quarterly journal published between 1843 and 1868. Initially they advocated strict adherence to medieval models:

> Instead of new designs, . . . real ancient designs, of acknowledged symmetry of proportions or beauty of detail should be selected for exact imitation in all their parts, arrangements and decorations.
>
> *The Ecclesiologist,* I (1843)

Churches of the Middle-Pointed Gothic style—now generally called decorated—of the late 13th and early 14th centuries were especially recommended as models. By the 1850s and '60s the aesthetic of the strict copyist was relaxed, and in its place there were new concerns such as the use of the general principles of Gothic architecture to create a suitably monumental town church.

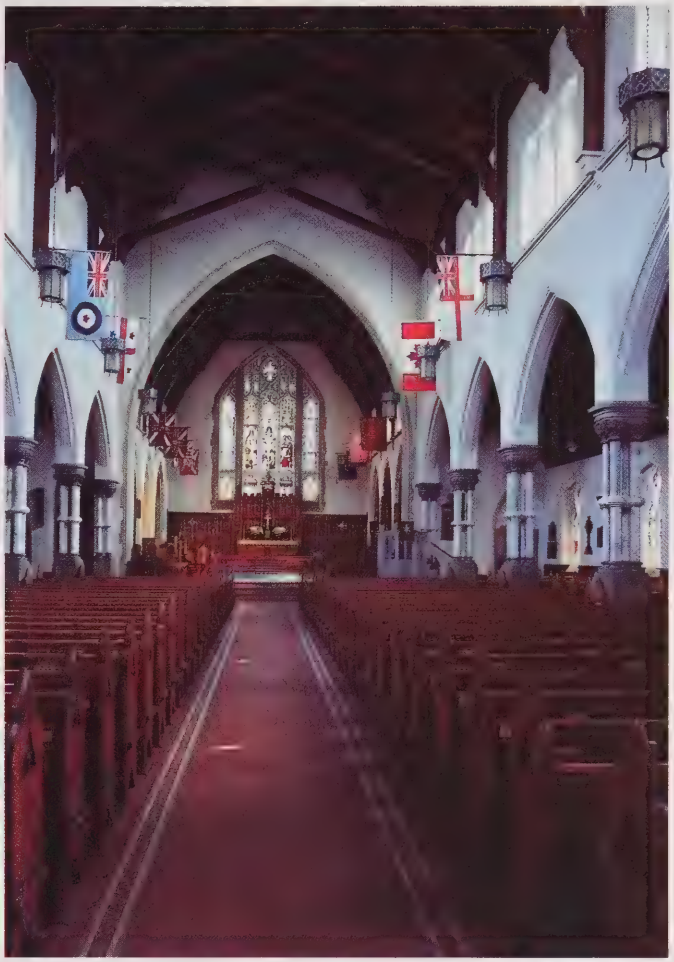
In Canada, however, the overwhelming desire of the Anglicans seems to have been the recreation of the image of the English medieval village church. This is clearly seen in the church of Saint Alban the Martyr, built between 1867 and 1877 by Thomas Fuller and King Arnoldi. The design is based on a church like Saint Michael's, Long Stanton (Cambridgeshire), with a separate chancel, nave, and porch; a steeply pitched roof; and a belfry. Inside, the division between nave and chancel is clearly expressed with the chancel arch. The arrangement of fittings follows medieval precedent. The font is placed at the west end of the nave, there are pews for the congregation, and the pulpit and lectern flank the chancel arch. The chancel is raised three steps higher than the nave and holds the choir stalls in the western section and the high altar at the east end.

In contrast to the mock cathedral grandeur of the sham rib vaults of Notre-Dame Basilica, at Saint Alban the Martyr the timber of the roofs is truthfully exposed in the proper medieval manner. One of the problems with the design of Saint Alban the Martyr, however, is that it failed to make a strong architectural statement for the church in the urban environment. The romantic notion of the recreation of the English village church can be experienced more readily in the city in the church of Saint Bartholomew, completed in 1868, or better still in the numerous near-contemporary rural Anglican churches in the Ottawa region such as Saint John the Evangelist, Oxford Mills; Saint Anne, Oxford Station; and especially at Saint Paul, Almonte, where the original Gothic rectory is picturesquely grouped behind the church.

A more monumental expression of the Anglican faith was created by King Arnoldi in Christ Church Cathedral in 1872–73, to which the chancel was added by A. J. Hazelgrove in 1932. In contrast to Saint Alban the Martyr, Christ Church boasts a two-storey nave flanked by aisles, a large traceried window in the façade, and an angle tower and spire, all more appropriate for a cathedral than for a parish church. It is true that Christ Church lacks the grandeur of Notre-Dame but, unlike the Catholic cathedral, it does have a truthful open timber roof.

Towers were not confined to cathedrals; rather they became increasingly popular as beacons of religious establishments in the urban environment. The tower would almost invariably be placed at the angle of crossroads to make it more prominent.

By the third quarter of the 19th century Protestant denominations adhered to the Catholic and Anglican trend of building in the Gothic style. However, the longitudinal emphasis of the medieval basilican plan was not well suited to the needs of Protestantism with its emphasis on preaching. Baptists, Methodists, and Presbyterians required a closer grouping of the congregation



around the pulpit. The usual solution to the problem was to shorten and widen the medieval plan and to include galleries along three sides of the sanctuary.

In Saint Andrew's Presbyterian the plan follows the wider proportions characteristic of Protestant churches, and also includes short transepts. Inside, the nave arcades are surmounted by low clerestory windows, but rather than maintaining an even rhythm of bays in the arcade, the bay facing the transepts is wider and taller than the others. To have larger arches leading into transepts is the norm in Gothic architecture, but William Tutin Thomas's adaptation of the furnishings is quite ingenious. The pulpit platform is located in the west transept where it is emphasized by the frame of the large arch and is further aggrandized by being surmounted by the rib vault in the transept. The pews are disposed in an angular U-shaped plan around the pulpit platform to achieve more direct focus of the congregation on the pulpit.

Such deviations from medieval planning had no place in Anglican and Catholic churches; the basilican arrangement served them well. At Saint Patrick's on Kent Street between Nepean and Gloucester streets, the basic design, executed between 1869 and 1875, is by Augustus Laver and King Arnoldi, but the sacristy, baptistery, transepts, and spire are all later additions that were finished by 1898. The richly decorated interior contrasts sharply with Saint Andrew's Presbyterian as does the continuation of the regular rhythm of the main arcade across the transept arms, which occupy the width of the two bays next to the high altar; an arrangement that is paralleled in the churches of E. W. Pugin. The stained glass of the aisle and transept windows comes from Mayer and Company of Munich and New York and dates from the turn of the century. It completes the Gothic aesthetic of the church and is a fine example of the so-called Munich style, in which scenes or individual figures

Left: The interior of Saint Alban the Martyr. The timbers of its roof are truthfully exposed in the proper medieval manner.
Right: A monumental expression of the Anglican faith is presented by the interior of Christ Church Anglican Cathedral.

Above: One of the beautiful stained-glass windows of Saint Patrick, Ottawa, depicting the Holy Family with the infant John the Baptist. Created in the Munich style, the figures are set beneath an elaborate canopy based on late German Gothic design.
Right: Saint Patrick's interior.

are set beneath elaborate canopies based on late German Gothic designs, the whole being framed with richly foliated borders.

The initial focus of Pugin and his followers in the revival of truly medieval Gothic forms was in the realm of church architecture. However, there can be no denying that the churches are neither the best known nor the most famous Gothic monuments in Ottawa; that honour belongs to the Parliament Buildings. The three buildings were originally constructed between 1859 and 1866 and are arranged in a large U-shape set well back from Wellington Street to the south, above the Rideau Canal to the east, and a sweeping curve in the Ottawa River to the north. The designs were produced by two architectural partnerships: Thomas Fuller and H. Chilion Jones were responsible for the Centre Block and the Library, while the East and West Blocks were entrusted to Frederick Warburton Stent and Augustus Laver. Of the original complex, the Library and East Block remain intact albeit with the addition to the latter in 1910–11 of a wing to house the Department of Finance. The West Block has undergone numerous additions and the Centre Block was destroyed by fire in 1916 and was subsequently rebuilt by John A. Pearson.

The buildings have a truly international importance for the history of the Gothic Revival. After the 1834 fire, the English Houses of Parliament in London were rebuilt in the Gothic style. Pugin designed the detailing, which was closely based on Henry VII's Chapel at Westminster Abbey, located across the road. Ottawa's Parliamentary Library has a central plan based on the plan of an English Gothic chapter house, one of the best examples of which is at

The Gothic interior of Saint Andrew's Presbyterian shows the shortened and widened variation of the medieval basilican plan.

The Parliament Buildings are Ottawa's most famous Gothic structures.

Westminster Abbey. It is just this sort of comparison that puts into perspective the Canadian Parliament Buildings. Rather than being pedantic copies of precise medieval models, they are the product of an eclectic understanding of the principles of Gothic design, not just in England, but throughout Europe.

Referring to their design for the Centre Block, Fuller and Jones stated, "The designers have endeavoured not slavishly to copy the Gothic of any particular period or country but the noble civic buildings of the Low Countries and Italy have afforded them suggestions." Fuller and Jones were obviously aware of Scott's 1857 Gothic project for the Foreign Office in London, and both the teams of Fuller and Jones and Stent and Laver were influenced byJohn Ruskin, the author of *The Seven Lamps of Architecture* (1849) and *The Stones of Venice* (1853), and by William Butterfield.

The parliamentary committee responsible for the reconstruction of the Centre Block after the 1916 fire instructed the architect, John Pearson, that his design, down to the details and construction materials, was to be based on the original structure. Pearson conformed, although an extra storey was added and the tower heightened. His detailing, however correct, lacks the vigour of the original.

It is surprising, given the use of Gothic for the Parliament Buildings, that this style did not enjoy greater popularity for other building types. Perhaps the new National Gallery of Canada, which is a very special tribute to those picturesque structures above the Ottawa River, will create a new appreciation and enthusiasm for this style.

Dr. Malcolm Thurlby, F.S.A., is associate professor of visual arts and director of the Graduate Programme in Art History at York University, Toronto.

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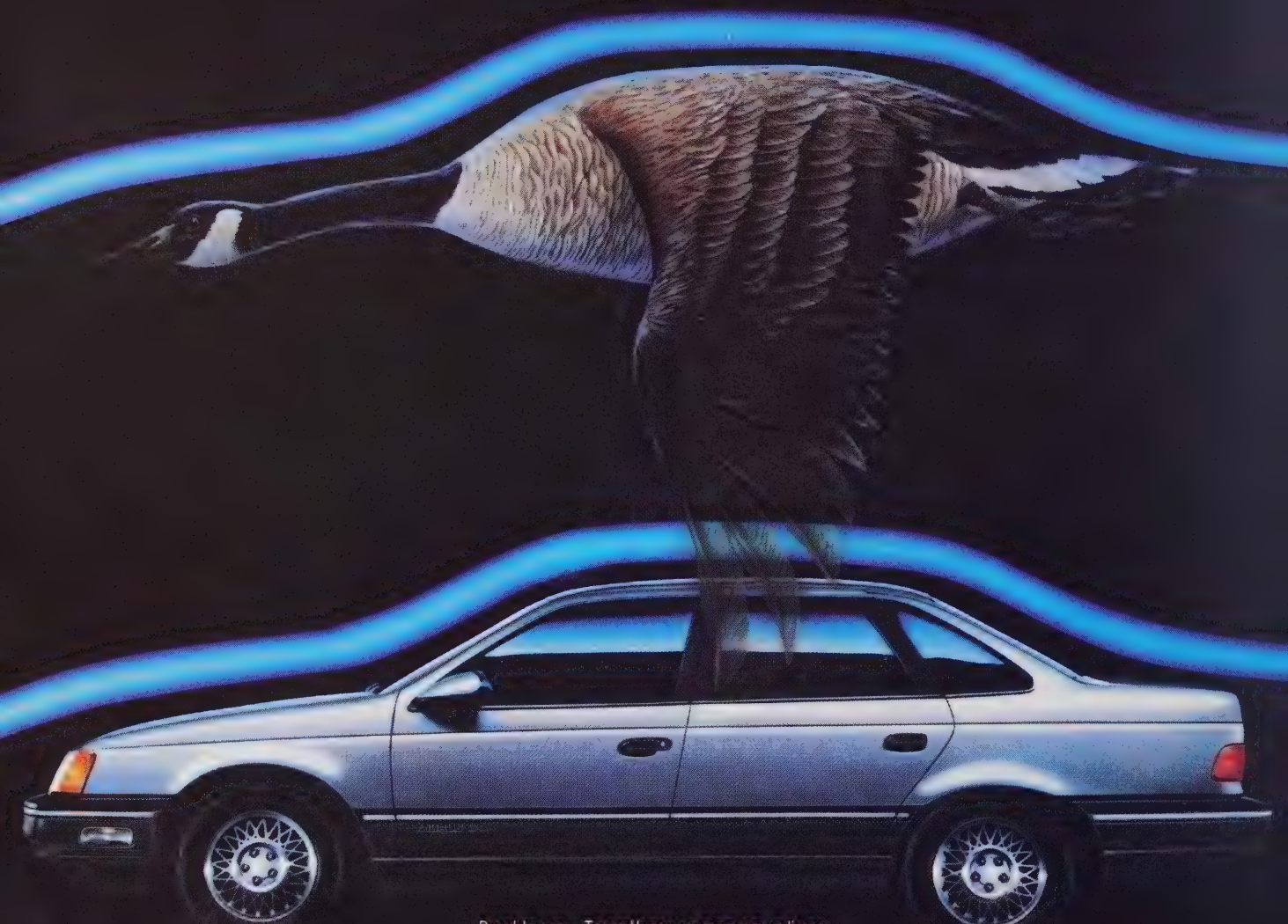

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NEW WORLDS

A night with the Canada-France-Hawaii Telescope

How rare are we?
A team of Canadian astronomers has found planets around other suns

Bill Johnstone

IT is noon at the Canada-France-Hawaii Telescope. Bruce Campbell at forty, his black hair just faintly silver-tipped, looks younger than most professional astronomers. He's wearing jeans and, over his yellow plaid shirt, a sweater the colour of the sun. Campbell is scanning the horizon for weather, high up on the summit of Mauna Kea.

Mauna Kea: it's an overwhelming spot, this dormant volcano on Hawaii. Measured from its base, twelve hundred metres under the sea, Mauna Kea rises as the world's loftiest mountain; it is about ten times as great in volume as Everest.

Mauna Kea straddles 20° north latitude, basking below the Tropic of Cancer. Yet Campbell's feet crunch on a patch of crusty snow; it's often freezing up here. Mauna Kea's weather is clear most of the time. But when that southern jet stream hits, the wind can reach hurricane force. It once blew a truck's doors right off. Just standing up is tough at 100 knots.

COURTESY NATIONAL RESEARCH COUNCIL

This gorgeous turquoise vista, with active Mauna Loa volcano to the south, produces something like rapture. Yet it's so *bleak*. Astronomer René Racine once worked on this crest. Noting these slopes of rusty volcanic rock, this utter lack of greenery, he compared Mauna Kea to the Viking photos of Mars.

Which seems appropriate for CFHT, the Canada-France-Hawaii Telescope. Set here on the crater's rim, anchoring one end of a semicircle of other domes and radio dishes, CFHT seems imposing. Its base, even without the immense vault above it, stands five storeys high.

Dr. Campbell's project has absorbed more nights than any up here: five or six two- or three-night sessions a year over the last seven years. At $25 000 a night, this part of his project has run over $2 000 000.

It's money well spent. Bruce Campbell, with Gordon Walker, has found new worlds.

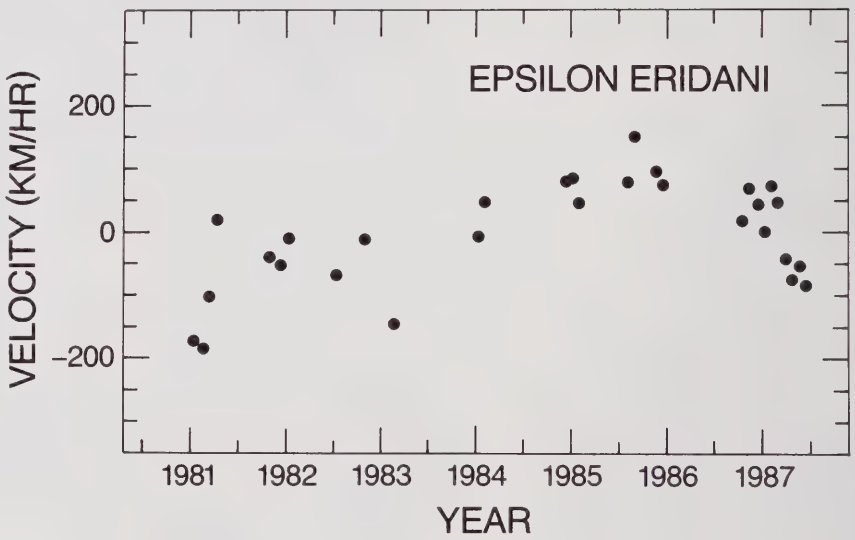
★ ★ ★

Unseen companions, but no brown dwarfs

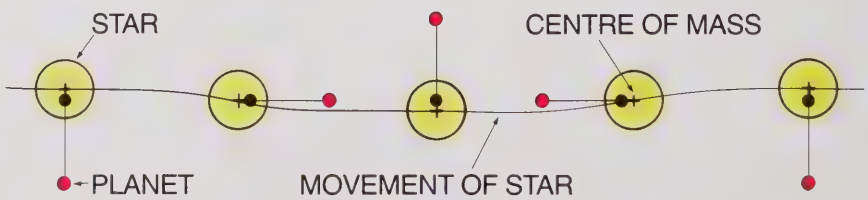
Campbell and Walker asked two questions: Are planetary systems common? And how do planetary systems form around stars? To get answers they figured out the best way yet to find planets orbiting other stars. Using the gigantic Mauna Kea telescope, for seven years they have observed thirty-one nearby stars, several of them are orbited by planets bigger than Jupiter.

René Racine, now a University of Montreal professor and director of the Megantic Observatory above the Quebec/Maine/New Hampshire border, was CFHT's second director. Remarking how we earthlings know only our own solar system, Racine says that seeing another will tell us what planetary systems have in common.

The line-of-sight velocity for Epsilon Eridani, measured with the Canada-France-Hawaii Telescope, is shown for the past six years. Scientists were able to measure individual points accurately to within 40 km per hour. The general trend of increasing velocity from 1981 until 1985 and of decreasing velocity from 1985 to 1987 could have been caused by an orbiting body, probably smaller than ten times the mass of Jupiter. Epsilon Eridani is located about eleven light years from the Sun, and has a mass equal to about eighty per cent of the Sun's. It is the fifth brightest star in the constellation Eridanus, which is visible in the southern sky in fall.



Both the star and its planet move about their common centre of mass. The motion of the star is relatively small. Such a slight motion of the star is what astronomers seek to infer the presence of the unseen planet. Knowing the size of the star's orbit and the orbital period reveals the mass of the planet.



Other observers have indirect evidence of debris orbiting nearby stars. But no one has detected planetary companions of the size found by the Canadian group. Campbell, currently with the University of Victoria, is the project's driving force. Gordon Walker from the University of British Columbia works on the equipment. And since 1985 Walker's postgraduate student Stevenson Yang has helped "boil down" their observational data by computer.

Twenty-five of the thirty-one stars under observation are about the size of our Sun (just average in size and brightness); the remaining six are large bright stars with known velocities, which serve as reference standards. They're all between ten and fifty light-years away.

The planet hunters regularly measure the radial velocity of each star, the velocity on the radius between the star and Earth. The measuring technique involves studying wavelength changes in each star's light, the familiar Doppler shift.

Every star moves towards or away from us. But if the star changes speed over time, chances are it's being orbited by a companion. What the team actually measures is the wobble, or reflex motion, of the star around the centre of mass of the two bodies. If you could observe from one of the newly discovered planets, you would see that Jupiter, during its twelve-year orbit, gives our Sun a reflex motion of about ninety kilometres per hour.

Two of the team's thirty-one target stars have turned out to be close binaries, pairs of stars in orbit around each other. One of these, Gamma Cephei, shows a slight additional wobble, indicating that a small third body may be present. Of the remaining targets, six vary significantly in velocity: Epsilon Eridani, 61 Virginis, Beta Virginis, Beta Aquilae, Xi Bootis, and 36 Ursae Majoris. Campbell feels we can be reasonably confident that these seven stars have planetary companions.

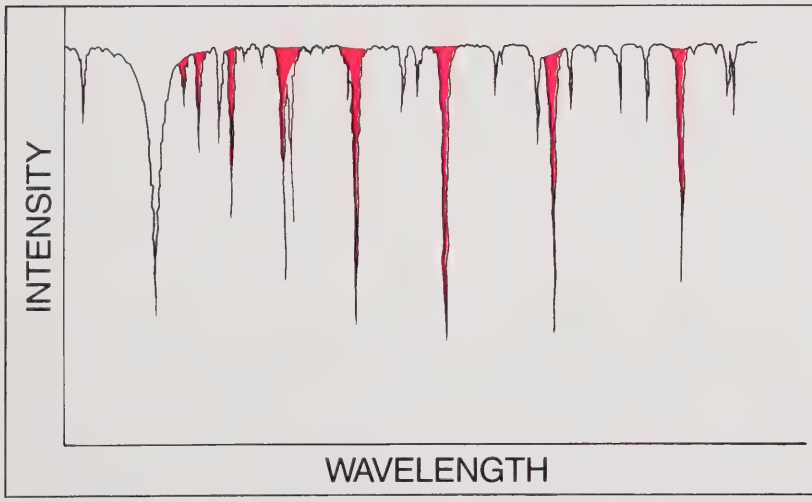
The team expected that half their stars would have brown dwarf companions—borderline bodies between planet and star size from, say, one-hundredth to one-tenth the Sun's mass. Startlingly though, after seven years they've found most of their stars show no significant change in velocity: no brown dwarfs.

The great puzzle in current astronomy is that, gravitationally, half our universe's mass seems to be missing. Theorists felt undetected brown dwarfs would account for much of that "missing mass." But the puzzle—whatever it is that keeps galaxies like our Milky Way together—is still missing a piece.

★ ★ ★

Mid-afternoon: riding the cage

Walker and Campbell, working three floors below the dome, bolt a metal tube eighty centimetres long to the front of the spectrograph. Campbell connects a tank to the tube, then opens its valve, letting in the gas.



Astronomers determine the speed that stars move toward or away from the Earth by measuring the wavelengths of the characteristic dips, called spectral lines, in the spectrum of a star. In older techniques the positions of the star's spectral lines were measured relative to those from a source of light inside the telescope. In the new technique, the reference lines caused by the hydrogen fluoride gas (red) are imposed on top of the star's spectrum. Recording these reference lines simultaneously with the spectrum of the star avoids types of measurement error.

This is hydrogen fluoride, wicked stuff. HF eats through glass, so each end of the tube is sealed with sapphire. When they started using HF a few years ago, questions were asked about having such a dangerous substance in the building. Even now, as Campbell heats it to one hundred degrees Celsius, a technician eyes the tube with apprehension, ready to fly from a leak.

Walker bolts a detector to the other side of the spectrograph, and they test their system. Then Campbell and Walker walk upstairs—slowly. They arrived last night to get acclimatized.

At 4205 metres most people get mountain sickness: nausea, short breath, even waking apnea—you realize suddenly that you haven't been breathing. Your senses dull; you get so confused you must work from check lists. The dry air is a problem too. Your mouth parches, your eyeballs dry, and your contact lenses fall out.

The dome feels like a cathedral. Its concrete floor, refrigerated to eliminate heat bubbles, wears a skin of frost. Voices and footsteps echo up in its vast hollow. A phone-booth-sized cage hangs up in the dome's centre, where the 3.6-metre mirror forms its first focus. The resident astronomer, a Hawaiian, is up there fitting a photographic plate, emulsion down towards the mirror. Campbell watches intently. Back in 1981 he was CFHT's first resident astronomer. "To ride in that cage," he reminisces, "to observe stars with this huge telescope, with the top of the cage open to the sky, looking out with the dome's slits on either side and the Milky Way above—it's really quite thrilling."

★ ★ ★

A captive gas

Over the last couple of centuries two theories have evolved to explain planet systems. The "close encounter" theory now has few supporters. It envisions a star passing close enough to another to pull material from it (or, one star of a binary pair disintegrating). A problem is that gases pulled out that way would explode off into space, not condense into planets.

Under the "revolving gas cloud" theory, first proposed by philosopher Immanuel Kant, a great cloud of gas and dust starts to revolve in space, contracting under gravity and flattening into a lens shape. If its central mass is less than eight per cent of our Sun's mass, the cloud won't build enough pressure to generate hydrogen fusion. Such a "threshold star" remains an invisible brown dwarf.

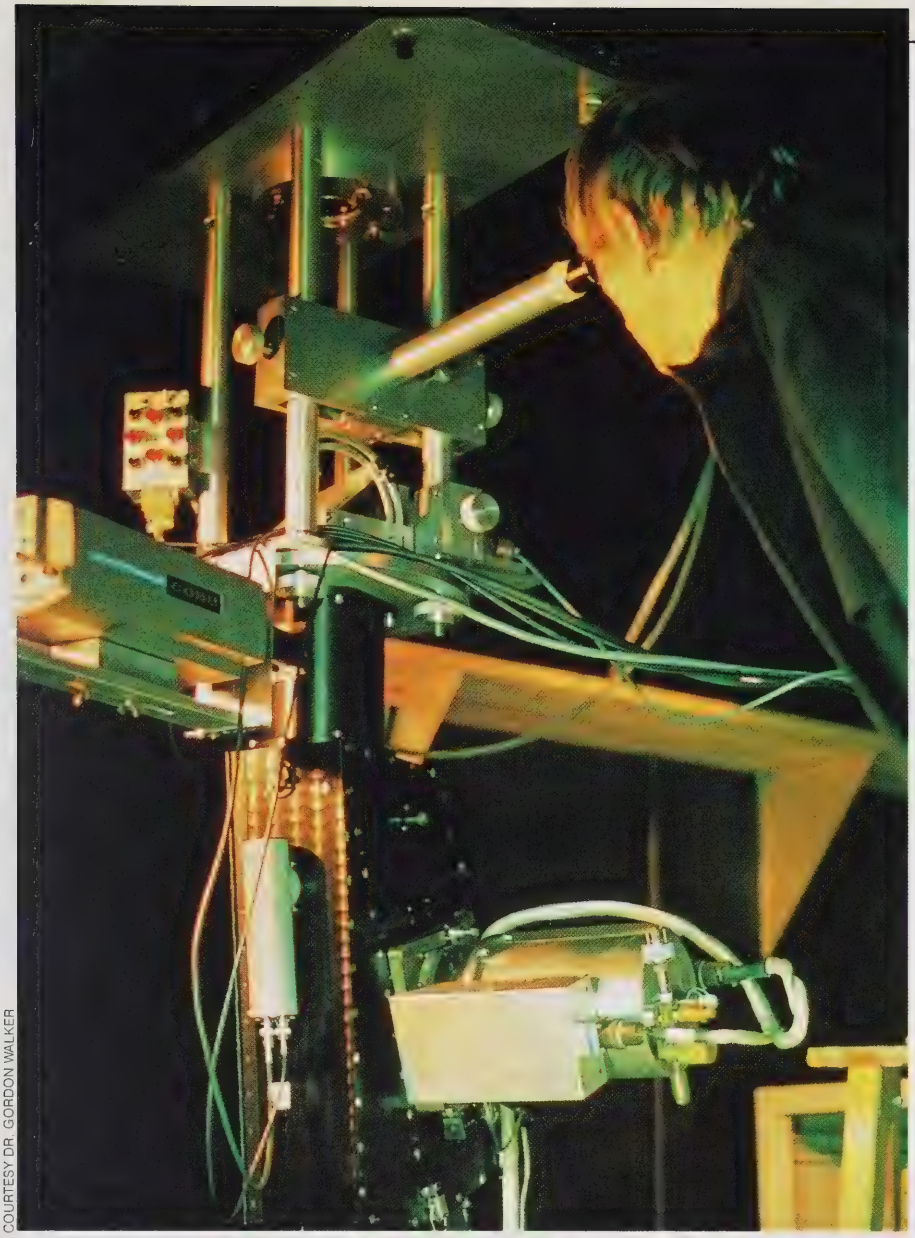
But with more mass, thermonuclear reactions produce a star. Hydrogen nuclei fuse to form helium, converting mass into energy aplenty. Our Sun is typical: 4.6 million tonnes "vaporise" into energy every second.

Astronomers think that just one per cent of a planetary system's mass remains outside the star, in concentric bands revolving at different speeds. Solar wind—atomic particles moving at escape velocity—blows out the material in these bands so that it collects in eddies. Over several billion years more and more specks are swept up, which condense into protoplanets. The bodies in each band then gravitate together to form true planet and moon subsystems. The heavier material in inner bands evolves into smaller terrestrial planets, while lighter gases further out become large Jupiter-like planets.

Campbell's great achievement was developing the HF spectrograph to search for planets. A spectrograph breaks a star's light into its "rainbow." Some colours' wavelengths are always missing because particular elements in the star remove that light; these show up as dark absorption lines or bands. A star's spectrum reveals a host of detail: the star's mass, density, chemical makeup, temperature, magnetic effect, rotation speed, and velocity.

Before, the means of measuring a star's radial velocity wasn't all that precise. The method involved taking two spectrograph photos. The first was of the star's spectrum. The second, taken immediately before or after, was of iron glowing right in front of the spectrograph. (Iron was used because it has a good spread of spectral lines.)

With the two photos astonomers could compare lines absorbed by iron in the star with lines emitted by iron on Earth. Any difference was due to the



COURTESY DR. GORDON WALKER

Gordon Walker adjusting a spectrograph.

Doppler shift: star motion towards us shifted the lines to blue, and motion away from us shifted the lines to red. Because the spectra weren't simultaneous, though, the method introduced errors. Velocity measurements, even after fine-tuning, were accurate to only 720 kilometres per hour.

As a UBC postdoctoral fellow in 1978, Campbell realized a new approach would eliminate the problem. Taking a photo of the spectrum of a star with a gas captured *in* the detector would superimpose the star's and the gas's lines simultaneously. Any thermal or mechanical distortions would move the lines of the star and the gas at the same time. The method would improve precision dramatically.

But which gas? Dr. Gerhard Herzberg, Canada's pre-eminent astrophysicist, recalls, "Bruce Campbell wrote to me about the problem they had, and I discussed it with [the late] Alec E. Douglas, who was working in our lab and was a very bright person." Douglas carried around in his head just such esoteric data. His answer: hydrogen fluoride.

Campbell and Walker modified their spectrograph to seal in HF gas, then tried it out. They found its precision simply amazing. They could detect a change of just 36 kilometres per hour in a star's velocity.

Several problems still had to be solved; experimental and light-source errors could still drastically obscure measurements. Yet Walker was optimistic from

E.T., Phone Home

Harvard's Search for Extra-Terrestrial Intelligence team has monitored radio waves since the 1960s, looking for a signal from "E.T." Now NASA is building a more sophisticated scanner for the job. Their quests blanket millions of targets. But both groups keep an eye on Canada's planet hunters.

The planets that Canada's team has found, however, are probably huge, gaseous, cold bodies unlikely to support life as we know it. Says Dr. Campbell, "When we can send a spacecraft to the stars, *then* we'll know whether there's life on the planets."

Dr. Gerhard Herzberg, Canada's senior Nobel-winning scientist, agrees, "Many people believe that surely there must be millions of [planetary] systems in the universe. And even in our galaxy. It's a hundred billion stars; there must surely be many that have planets. But nobody has (directly) seen them. And before that is done we don't really know whether there are places favourable for development of life."

With a speculative twinkle, Herzberg adds, "There are now people, quite prominent people, who believe that the Earth is the only place in the whole universe where life exists. I am not one of them."

the start. "I've never felt that it wasn't going somewhere. When you go to a lecture and astronomers talk about an area where they've made measurements, they have ten points on the line [of measurements] and three that lie off it. And they spend most of the time talking about the three that lie off it. We don't seem to have that sort of problem."

★ ★ ★

Night: seeing stars

Evening falls quickly in the tropics. CFHT's operator opens the dome and, looking through his cage eyepiece, guides the telescope across the sky. He focuses the scope on a bright star. Then Walker sends up the coordinates of their first target, and Campbell types in commands to open the shutter and make a few comparison exposures. They settle into the night's list of stars.

Campbell and Walker are not in the dome. They hear the motors humming up there, but they're several floors below, in an office equipped with computer screens. It's warm, pleasant. "It's a civilized way to work," Campbell agrees, "not like the old days when you were out at an eyepiece freezing to death." Televised observation, computerized tracking, digital recording—these seem novel to astronomers who messed with chemicals and photo plates in darkrooms a generation ago.

It is dull, yet stressful, staring for hours at a screen. Each exposure takes up to an hour. Campbell concentrates totally on observing the star image reflected down to his equipment.

Mauna Kea is the world's best site for "seeing." That's what astronomers term the blurring of star images, measured in seconds of arc, because of the atmosphere. Each tenth of an arc-second is significant: by having a star's light concentrated into a smaller area you can see starlight that otherwise would be too scattered to observe. A telescope's resolving power actually matters more than its magnifying power.

A cold prairie night offers "seeing" of five to ten arc-seconds. The best telescopes in Chile and Arizona rarely resolve to better than one arc-second. But Campbell regularly gets images as sharp as 0.5 and 0.4 arc-second here on Mauna Kea.

Campbell monitors the signals on his screen, applying new calibrations several times a minute, collecting as many photons (bits of light) as possible. He's always thinking—not easy on Mauna Kea. Some up here listen to heavy metal rock to get through the night. Campbell prefers Mozart.

★ ★ ★

The next generation

Campbell needs another five years of observation. Because the unseen planets are assumed to be like Jupiter (based on the wobble they impose on their stars) they will take that long to complete their orbits. Only then can Campbell accurately know their masses. In the meantime his technique may be superseded by those of other groups. That's fine by Campbell; he's anxious to have someone get observations that confirm his.

For example, George Gatewood at Allegheny Observatory uses astrometry (direct measurement of motion across the sky) to look for planets. His detector measures quite precisely, using fibre-optic photometers instead of photo plates at the focal point. Unlike the spectrographic method, though, astrometry's useful measurements are restricted to nearby stars.

Our ability to directly see Earth-size planets is maybe a decade away. The next generation of equipment begins with the Hubble Space Telescope, scheduled for orbit next year. SpaceTel may provide "seeing" of just one-tenth of an arc-second. But working with it will be expensive; you can't just hop on a 747 to get to it. Moreover SpaceTel won't be equipped to measure a star's radial velocity; Campbell's spectrographic velocity technique will remain an essential complement.

The 2.4-metre mirror in SpaceTel will have just half CFHT's light-gathering ability. The Keck telescope, however, to be built by the University of California

COURTESY NATIONAL RESEARCH COUNCIL

Dawn breaks over the Canada-France-Hawaii Telescope.

and Cal Tech, will be on Mauna Kea in 1991. At about 157 centimetres in diameter it will be the largest telescope ever, eclipsing both the Soviet 93-centimetre and Palomar 79-centimetre devices.

★ ★ ★

Salmon pink oozes up slowly, fading the black sky. Campbell and Walker finish tracking their last star, then back up their mag tape. One last coffee, then they stroll out into the cold.

Sleeping is difficult on Mauna Kea, so the astronomers drive down to CFHT's open-air office and dormitory, halfway to sea level. High behind their car the sun flares into morning. Tomorrow they'll do a little skin diving, maybe even tag along on a boar hunt.

Their real work won't begin until they're back in Canada. Despite astronomy's image, observation is a small part of the job. Most pros average just twenty or so observation nights a year. Their research mostly involves calculating velocity measurements by computer to get meaningful results. And research occupies only half their time. They invest long hours building equipment, teaching, and fussing over administrative details.

Campbell says, "I understand we're doing this at the request, the wishes, of the taxpayer. It's a privilege, there's no doubt about that. The opportunity to do any kind of research like this is really a bonus. The research is the cream." His softly glowing enthusiasm echoes something his University of Victoria colleague Chris Pritchet said recently, "We're in a new era, just in the last few years. The next decade is going to be the most exciting time, the Golden Age of Astronomy." Bruce Campbell, steering down the olive and ochre switchbacks of Mauna Kea's cinder cone, is already exploring the Golden Age's new worlds. ❦

Dawn: astronomy's golden age

Bill Johnstone is a freelance science writer living in Victoria, British Columbia.

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HOME AT LAST

After more than a century, the National Gallery of Canada finally has a permanent home

Geoffrey Simmins

At Queen and O'Connor . . . is one of the places the tourist should not fail to visit. It is *The National Art Gallery.* There is here a large collection of fine oil paintings, well worth seeing. In the same building as the Dominion Fisheries Exhibit, but possibly what will most interest the many is *The Ottawa Fish Hatchery* . . .

Anson A. Gard
The Hub and the Spokes, or, the Capital and its Environs, 1904

NO more jostling for space with the Fisheries Department and languishing in "temporary" homes; no more waiting for the results of decades of studies on half a dozen sites. More than a century after being created by statute, the National Gallery of Canada has a home.

The site finally selected overlooks the Ottawa River near Nepean Point at the junction of Sussex Drive and Saint Patrick Street, across from Notre-Dame Basilica—its gracefully proportioned twin towers painted silver in the French Canadian manner—and adjacent to the blocky, undistinguished Royal Mint. Parliament Hill offers the most favourable prospect: from here the Gallery can be seen in the picturesque context of the grand sweep of the Ottawa River, the mouth of the Rideau Canal, and the Alexandra Bridge.

The new National Gallery of Canada. From its elegant glass towers, visitors can enjoy spectacular views of the Rideau Canal and two traditional Ottawa landmarks: Notre-Dame Basilica and the Parliament Buildings.

COURTESY NATIONAL GALLERY OF CANADA

Moshe Safdie, the design architect of the new National Gallery, was chosen after the results of an invitational competition initiated in 1982 by Dr. Jean Sutherland Boggs, former director of the Gallery, who headed a subsequently dismantled National Museum Construction Corporation. Safdie is known to most Canadians as the designer of Habitat at Montreal's Expo '67. Born in Haifa, Israel, in 1938, Safdie came to Canada as a teenager and graduated with a degree in architecture from McGill University in 1961. The National Gallery represents his first major commission in Canada since his precocious and wildly successful design for Habitat.

What are Safdie's attitudes to architecture, and how are they reflected in his design for the National Gallery? In such publications as *Beyond Habitat* (1970), *For Everyone a Garden* (1974), *Form and Purpose* (1982), and "Private Jokes in Public Places," *The Atlantic Monthly*, (December 1981), Safdie defined a critical position strongly advocating modular design principles that are sensitive to local design traditions. Paradoxically respecting history and new technology in equal measure, he has demonstrated little patience with what he sees as the facile and self-indulgent architecture characteristic of North America in recent years. For instance, in his *Atlantic* article Safdie wrote:

> I believe that Post-Modernism has merely absorbed into its dogma current values in the works of art, fashion and merchandizing—the rise of narcissism, the hunger for novelty, and deep pessimism about the prospects for humanity that have descended upon us in the past decade.

Such writings—not popular in some segments of the architectural community—show him to possess an independent, vigorous, and slightly querulous

The National Gallery of Canada stands majestically at the junction of Sussex Drive and Saint Patrick Street. Its glass outer shell is a modern tribute to the graceful lines of Ottawa's Gothic structures.

GEOFFREY SIMMINS

voice. However, his views on contemporary trends in architecture are more ambivalent than they first appear. For instance, although Safdie has denounced Postmodernism's visual clichés and muddy thinking, aspects of his design for the National Gallery are in keeping with certain Postmodern attitudes. For example, the Gallery's dramatic entrance is a significant departure from his earlier work, which was based on standardized forms. And if in the past Safdie emulated the design principles of vernacular architecture, the National Gallery's design reflects a new interest in high-style architectural history. Modular design is no longer important, and it is clear that the traditions of 19th-century European museums were influences in the creation of the Gallery.

Another factor must be considered when assessing Safdie's approach to the design for the National Gallery. As is typical of many architects at mid-career, Safdie had been expressing a nearly obsessive desire to face the challenge of conceiving a major building. One could imagine him charged with the serious sense of purpose possessed only by those in the full bloom of their own talents, yet faintly aware of the rank scent of mortality. The commission for the National Gallery of Canada became the needed challenge. Safdie responded to the commission by lavishing it with attention.

And finally, Safdie was working with a sensitive and informed client. His approach was tempered by the deliberately historicist method advocated by Jean Boggs, who organized visits for him to various museums in North America and Europe.

Studied and historicist the Gallery might be, but it nonetheless possesses its own character. To picture the new Gallery, imagine a squarish, low building

The curatorial centre of the new Gallery.

JUSTIN WONNACOTT

faced in large blocks of warm-hued, pink-grey granite, finely dressed but not polished. The roofline is broken by strategically placed, stubby octagonal towers, all in glass. One of these towers, on the southwest corner facing the river, is higher than the others. This blocky tower, housing the Great Hall, is the most striking feature of the elevation.

The building's main elevation faces south; along this face runs a ceremonial ramp that links the Great Hall with a corner entrance pavilion on the east side. A wall of glass punctuated by slender piers gives prominence to the exterior wall of this ramped corridor—a ramp so wide and processional that one Ottawa architect dubbed it "Ben Hur Way." This ramped corridor—essentially an exterior street that is separated environmentally from the rest of the galleries—pays tribute to the Scala Regia in Rome, with the Corridoio del Bernini leading to it. Safdie visited the Scala Regia and photographed it when he was conducting research for the Gallery.

The Great Hall unifies a building of parts—Canadian galleries, temporary exhibition spaces, contemporary wing, and the separate curatorial block linked by skywalks on the north face—each possessing a distinct character. Without the Great Hall the design would be incoherent.

The new Gallery contains more than twice the space of the Lorne Building (the Gallery's home since 1960): 11 961 m^2 compared with 5052 m^2. Of that space the Canadian historical painting galleries will occupy nearly a third—3381 m^2. Many visitors will remark upon the diversity of the building's interior spaces. Not only are the galleries differently lighted and of different heights, but even the floor materials are varied—white and red oak in the historical painting galleries and maple in the contemporary wing.

Despite the conscious variety in interior spaces, however, there is an overall harmony and unity to the design. In part this is achieved by the architect's use of dramatic geometry in public spaces: the ramped entrance and balconied concourse perpendicular to it, a double-armed staircase rearing up from the corner of the Great Hall, and giant bay windows. Meticulous attention has been paid to detail, such as incised ornament above doors and along stringcourses. This imparts a neoclassical quality to the design.

Works in the historical painting galleries, both European and Canadian, are displayed in a succession of generously wide galleries with shallow barrel vaults flanked by narrow, half-vaulted galleries. Three permanent architectural interiors are installed in the Canadian galleries, including the reconstructed Rideau Street Convent Chapel, designed in 1887 by diocesan architect Canon

JUSTIN WONNACOTT

JUSTIN WONNACOTT

Georges Bouillon (see page 50). Period Canadian silver and ecclesiastical sculpture are displayed in the chapel—an example of the curators' policy of displaying sculpture side by side with paintings and the decorative arts.

There are three interior courtyards; each has a distinct character. Provided with ample seating, they are logical places to meet and to rest.Because works of various media are interspersed and the galleries are so different from one another, visitors will not have to face the monotonous corridors and the acres of paintings found in so many European museums. However, traditional wooden flooring was chosen because studies showed that its resiliency makes it less tiring to the feet than carpet or concrete.

To light the interiors of the main Canadian galleries, Safdie devised seven-metre-deep mirrored spacewells; the European galleries are lit by shallower skylights that do not need the elaborate mirrored system. Such top-lit skylights derive from Sir John Soane's Dulwich Art Gallery and from his own house and museum, both of which date to the first quarter of the 19th century. The modern precedent for such lighting is Louis Kahn's Kimbell Art Museum (1966–72) in Fort Worth, Texas.

The characters of the various galleries result in part from discussions between Safdie and the curators. For example, the main contemporary art gallery is stark and angular: its squared planes provide a marked contrast to the shallow curved vaults in the European and Canadian painting galleries. Although some of the contemporary galleries are skylighted, most employ flat ceilings, track lighting, and neutral maple flooring.

A slightly perfervid air accompanying the celebrations over the completion of the new Gallery is understood by anyone familiar with the Gallery's history. For it has been anything but easy to achieve a permanent home for the Gallery.

Left: The Garden Court, one of the three interior courtyards, was photographed in June 1987 while still under construction.
Right: In June 1987, the main construction of the Great Hall was nearing completion.

continued page 52

Restoring the Rideau Street Convent Chapel

The Convent of Our Lady of the Sacred Heart, better known as the Rideau Street Convent, was demolished in the spring of 1972, in spite of protests by local heritage groups. The last-minute efforts to save the building lead the Historic Sites and Monuments Board of Canada to declare the interior of the convent's chapel of national architectural significance. Today an unattractive two-storey commercial complex and a parking lot occupy the site. However, the chapel interior, which became the focus of this heritage struggle, was saved and has now been restored and reconstructed in the heart of the Canadian galleries of the new National Gallery of Canada.

In 1869 the Convent of Our Lady of the Sacred Heart, run by the Grey Nuns of the Cross, moved into a hotel on Rideau Street in Ottawa. Its school grew in prestige and enrolment increased as the French and Irish Roman Catholic community of Ottawa expanded. In 1887 it was decided that a prestigious chapel was required that would be worthy of the institution and expressive of the goals of a Christian education. To this end the Grey Nuns of the Cross requested plans from Georges Bouillon (1841–1932), priest and amateur architect and author of the plans for the recently constructed chapel of the Mother House of the Ottawa Grey Nuns.

Originally from Rimouski, Quebec, Georges Bouillon had been educated in Montreal and Ottawa, and from 1874 he occupied various offices at the archdiocese headquarters in Ottawa. His most important architectural project was the completion of the decorations of the interior of Notre-Dame Basilica on Sussex Drive (1876–88). In this Bouillon was clearly inspired by Victor Bourgeau's design of the 1870s for the interior of Notre-Dame in Montreal, so much so that Bouillon even engaged the young sculptor Louis-Philippe Hébert, author of the superb pulpit carvings in the Montreal church, to execute the numerous sculptures required for the Ottawa altar.

The most striking and unique feature of the interior of the Rideau Street Convent Chapel is the superb wooden fan-vaulted ceiling supported by iron columns. Ostensibly inspired by the chapel of Henry VII at Westminster Abbey, though actually closer to the ceiling of King's College Chapel, Cambridge, Bouillon both simplified and amplified his 16th-century models. Here the spandrels between the larger nave vaults (6.6 metres in diameter) become the springs for the alternate, smaller aisle vaults (3.4 metres in diameter), creating a weaving interplay between the wide nave and slightly lower side aisles. The roundels between the vaults are also more prominent, their sculptured decoration and overall form echoing the decorations of the spandrels. Certain of the mouldings do recall details in Notre-Dame Basilica but the overall concept is more inventive and richly sculptural. To this the architect added the ornate neo-Gothic reredos that spans the width of the chapel and the three altars facing the side aisles and the nave.

At the time of the dedication of the chapel on 25 June 1888, certain finishing touches were still required, and today the chapel is almost true to Bouillon's 1887 design. The major changes are in the painted decorations.

From a photograph taken in 1900 one can see that the flat east wall behind the reredos was originally painted with *trompe-l'oeil* vaults and windows. The painted decorations were relatively plain, limited to flat colours merely defining the main forms and ornament.

In 1909–10 an unidentified Italian decorator redecorated the chapel interior by overpainting the *trompe-l'oeil* vaulting with an Annunciation to the Virgin over the north altar, Saint Michael and the dragon over the south altar, and over the main altar a choir of angels with the Holy Ghost. On the ceiling he painted trefoils on the spandrels and floral decorations on the roundels, and on the walls he stencilled elaborate pointed arches over the Stations of the Cross. The reveals of the windows were decorated with *trompe-l'oeil* panelling.

The well-known firm of T. Carli-Petrucci of Montreal carried out the final redecoration in 1944–45, on the occasion of the 75th anniversary of the convent. Essentially this consisted of a simplification of the 1909 decoration by eliminating the floral motifs and trefoils on the reveal of the spandrels, and by painting new stencilling, still in a neo-Gothic vein, on the walls. Behind the altars Charles-Albert Chabauty (1879–1953) repainted the east wall decorations, reducing the aisle paintings and enlarging the nave composition.

Given the haste with which the chapel interior was dismantled in 1972, it was possible to save many but not all of the elements. Saved from the wrecker's ball were almost the entire fan-vaulted ceiling (except for those pieces cut out during the disassembly and broken sections), the complete reredos and altars, the communion and balcony railings, corbels, capitals, and iron columns (the columns, having been stored outside for twelve years, lost their original finish), drop mouldings over the windows, and the window sashes. Elements destroyed in 1972 included the structural walls with their painted stencilling and east wall decorations, the wainscoting, wooden floor, balcony, doors, and window frames.

Lengthy discussions took place about how best to present the surviving elements and utilize the space in the new National Gallery. Proposals ranged from installing the ceiling and columns in the new Gallery library to merely installing the ceiling, columns, reredos, and altars within a neutral and somewhat larger gallery space. The latter approach essentially dealt with the chapel elements as architectural and sculptural artifacts that would be displayed with other religious works of art. The Gallery consulted various people but the most im-

Top: The south aisle of the chapel after it was redecorated in 1944. This photo was taken just before the dismantling of the chapel and the demolition of the convent in 1972.

Bottom: The interior of the chapel as it was decorated from 1910 to 1944.

portant contribution came from Parks Canada.

Julian Smith, former head of the Restoration Services Division of Parks Canada, led the National Gallery staff through the various options, and Ken Elder, the Senior Architect in the Period Architecture Section, Restoration Services Division, ultimately became responsible for all aspects of the chapel's design. All concluded that the chapel interior could be understood only as an architectural structure and not as dislocated fragments. This required the restoration of the surviving elements and full reconstruction of the destroyed elements, with the exception of the east wall paintings. The chapel has been restored to the appearance it had in 1972. All fill in the ceiling was painted but no original finish was overpainted.

The process of historical research, inventory, stabilization, trial assembly of the fan vaults and windows, erection of the superstructure, restoration of the columns, final assembly of the ceiling, the construction and decoration of the walls, floors, and balcony, and the introduction of required lighting and other modern services took four years to complete. A schematic diagram and support material enable the visitor to differentiate clearly between reconstructed elements and original material, and to understand and appreciate this unique example of late 19th-century Quebec and Franco-Ontarian ecclesiastical architecture.

The Rideau Street Convent Chapel, together with the installation of the painted walls from the Croscup House of Karsdale,. Nova Scotia, painted by an unknown artist in the 1840s, and of the decorative panels painted by Tom Thomson, Arthur Lismer, and J. E. H. MacDonald for Dr. James MacCallum's cottage at Go Home Bay in 1915, will hopefully encourage a greater appreciation of the importance of preserving our architectural and decorative heritage, and of the concepts that link the various art forms at any given period.

CHARLES HILL
Curator of Canadian Art
National Gallery of Canada

GEOFFREY SIMMINS

The octagonal glass towers mark the entrance to the National Gallery of Canada.

Although in 1880 a National Gallery was founded on paper (along with the Royal Canadian Academy and, like the Academy, under the patronage of the Marquess of Lorne, then Governor-General), no provisions were made for the Gallery to house its collections—its complaint for the next one hundred years. Thereafter the Gallery was shunted around like a poor relation. In 1882 the collection moved to the old court house from which the Supreme Court Justices were about to depart, and in 1884 the collection moved to the new building of the Department of Fisheries on O'Connor Street.

In 1907 an Arts Advisory Council was approved by Parliament: its members were Sir George Drummond, Byron E. (later Sir Edmund) Walker; and Senator Arthur Boyer. In 1910 Walker became chairman of the Council and English-born Eric Brown was appointed the Gallery's first permanent director, a position he would hold for twenty-nine years until his death in 1939.

The Gallery moved from the Fisheries Building to the new Victoria Museum (its home for the next forty years) in 1912, but a fire on Parliament Hill in 1916 resulted in the virtual closing of the Victoria Museum for five years while space was sequestered for Parliament. By a curious coincidence, in 1915 a museum of fine arts had been proposed for the Sussex Drive site where the new National Gallery of Canada now stands. This proposal was inspired by a city-beautiful commission, which discussed ways in which Ottawa could be made into the Washington of the north. (There is no evidence that Safdie was aware of the 1915 proposal.)

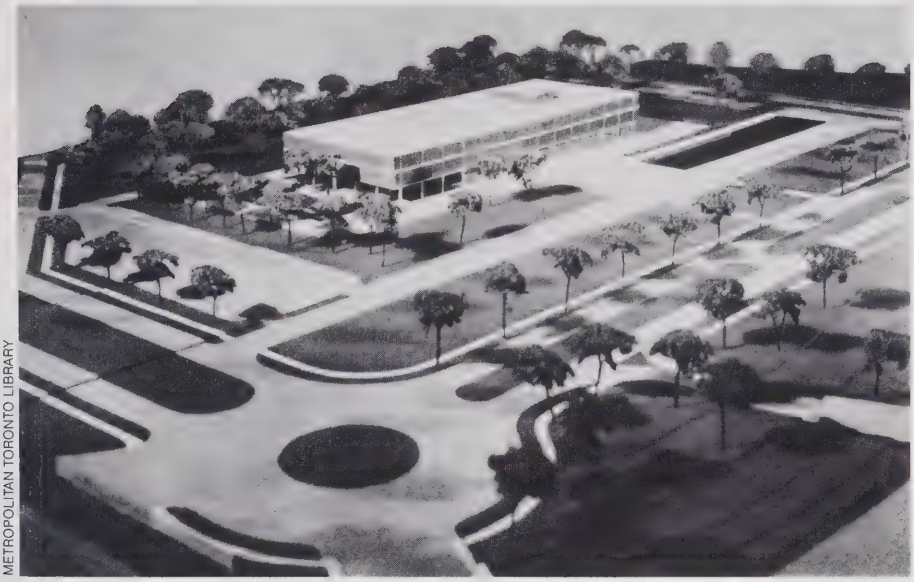
The 1915 museum of fine arts was conceived in schematic terms; nonetheless, there are some parallels between it and Safdie's building. Symmetrically located between the street block perimeters, the 1915 building was envisioned in the Beaux-Arts idiom, with appropriate courtyards and skylights. (It probably would have looked like E. and W. Maxwell's design for the Montreal Museum of Fine Arts, whose own Beaux-Arts building opened in 1912.) The scheme was oriented towards Sussex Drive, that is, with its main elevation facing east. (Safdie's building is oriented to the south.) A *cour d'honneur* flanked by auxiliary buildings led to the museum, which was roughly square in plan with a generous central court. A curved apsidal projection on the west side was the only feature on the river side. Walkways led from the museum to a formal park on Nepean Point. By another coincidence, both the 1915 scheme and Safdie's called for a garden to be located between them and the Mint. A combination of the Parliament Hill fire and World War I probably prevented the execution of the museum building.

Various other schemes were essayed in the 1920s, the 1930s, and in 1950 although not all of these are known in detail. These schemes, too, came to naught, however, and in 1952–54 another competition was held for a new National Gallery on the Cartier Square site; of 104 entrants, Winnipeg architects Green, Blankstein & Russell won the competition, but their design was said to have been rejected because of its International Style character.

The removal of the Gallery to the Lorne Building in 1960 was to have been temporary; but two more competitions were held before the temporary home was vacated. The site across the street from the Lorne Building was suggested but it was thought to be better for the proposed United States Embassy. Finally, in 1976–77, a competition was held for a site on Wellington Street. The Parkin Partnership won this competition over nine other entrants, but because of "current fiscal restraints" the design was not executed.

However, the 1980s could well be described as the decade of museums. The Canadian Centre for Architecture will open next year in Montreal. Extensions are underway (or proposed) at the Tate and the National Gallery in London, and even at Frank Lloyd Wright's Guggenheim Museum in New York City. No fewer than eighteen major museums have been constructed since the early 1980s in Germany. The Royal Ontario Museum reopened its doors in 1982, the same year that approval came for the construction of the new National Gallery of Canada.

The construction of large public buildings paid for from the public purse is invariably fraught with controversy. (Those interested in such matters might



Left: The style of the new building is very different from the one proposed by the Winnipeg firm of Green, Blankstein & Russell in 1954. The Winnipeg design won the competition but the government rejected it because of its International Style character.
Right: The site of the National Gallery proposed in 1916 in the *Report of the Federal Plan Commission on a General Plan for the Cities of Ottawa and Hull.*

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consult the 1862 report concerning the construction of the Parliament Buildings.) Although the Canada Museums Construction Corporation was established in 1982 with seed money in the amount of $186 million and a five-year deadline, and the design competition led to the appointment of Parkin/Safdie Architects Planners for the National Gallery of Canada, all has not gone smoothly since then.

Costs increased; niggling over non-essentials took place. Ottawa City Council, miffed over protocol, refused to waive $800 000 in permit costs. Outsiders were quick to offer advice. The vice-president of Christie's Canada wrote to the *Globe and Mail* with the disingenuous suggestion that cost overruns could be made up by deaccessioning works of art (and, presumably, selling them through Christie's). During the peak of the brouhaha over spiralling costs the construction corporation was disbanded as a cost-cutting measure. A scapegoat was required: Boggs was removed from the project. Toronto architectural critic Adele Freedman wrote that the whole debacle over cost overruns had been an instance of "math over passion."

While the new National Gallery should be viewed in the context of the many museums constructed in the 1980s, it should be considered also in the more confined context of Ottawa's history. For the Gallery's fortunes have been deeply coloured by the unpredictable, volatile nature of Ottawa and its shifting political will. Political will, not aesthetic choice, dictated that one site was chosen over another and then rejected or given over to someone else. Political will dictated that until the 1980s, when building new galleries became the rage the world over, Canadian conservatism in cultural matters prevented the funds being approved for construction. And the new National Gallery might still reflect political will rather than local need.

Elevated to a federal capital in the 1850s because of the need for political compromise, Ottawa did not ask for but has received the material symbols of a federal nation—the Parliament Buildings, the Supreme Court, the National Arts Centre, and dozens of little Lorne buildings, each housing an arm of the civil service. Ottawa is a curious hybrid of two spirits: one public and declamatory, the other evident in the lives of the people who have lived and worked there. The juxtaposition of the new Gallery across from the Roman Catholic cathedral implies a richly integrated urban pattern and texture. This is illusory; in fact each institution is primarily at the service of its own congregation.

In a 1971 monograph about the history of the National Gallery, Jean Boggs characterized the period from 1880 to 1907 as "years of obscurity." This description could apply equally well to much of the Gallery's subsequent history. By whatever standard we measure such things, however, Canada finally has a National Gallery worthy of the name.

Dr. Geoffrey Simmins is a Toronto freelance writer and lecturer specializing in Canadian art and architecture.

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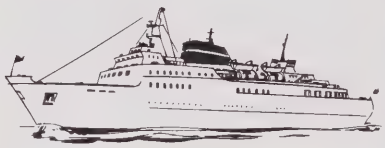

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▶The Greek and Roman Department has recently acquired a collection of 132 pieces of Byzantine art, dating from the 6th to the 13th centuries. Seven of the artifacts, created between A.D. 550 and 600, show the diversity of this outstanding collection.

A heavy gold ring is composed of a plain hoop and circular bezel that has a cross inlaid with niello, an alloy of sulphur and silver. This style of ring is characteristic of early Byzantine art. The cross declares the original owner's belief in Christianity, the official religion of Byzantium.

An exquisite pair of gold earrings with amethyst drops reflects the luxurious nature of Byzantine jewellery. The design of an openwork pendant with curled spokes enclosed by a beaded border was a Roman motif perfected by Byzantine craftsmen.

A shoulder length representation of Odysseus, which decorates the front of the gold belt ornament, is an excellent example of the classical heritage of Byzantine art. Odysseus is identified by his peasant's cap or *pilos*. The modelling of the face, shoulders, and wind-swept hair is an example of superb workmanship.

The lid and the sides of an oval-shaped reliquary casket are engraved with themes relating to the praise of the True Cross and eternal life in Heaven. This casket once contained the relics of a saint and would likely have been kept in a church.

An unusual bronze incense burner was cast in the shape of a female head. The top of the head is composed of a perforated, conical

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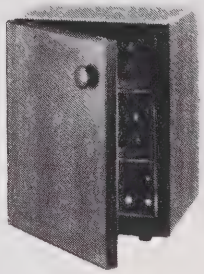

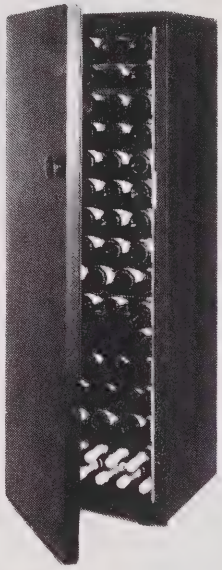

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lid surmounted by a cross and chain.

A token from the shrine of St. Simeon Stylites the Younger (died 592), located near Antioch, bears a portrait of the saint perched on top of a column framed by a pair of palm-bearing angels. Pilgrim tokens were produced at the holy sites where saints were venerated. The tokens, made from clay found at the sites, were thought to possess spiritual powers. If a person who owned a token fell ill, a possible remedy was a potion prepared by crushing the token to powder and mixing it with water.

And finally, a silver ring of Jewish origin is one of the rarest pieces in the collection because ancient Jewish jewellery was seldom made from a precious metal and little has survived. A menorah, lulav, and ethrog are engraved on the ring's bezel. The menorah, a seven-branched candelabrum, symbolizes the Jerusalem temple. The lulav, formed from intertwined branches of palm, myrtle, and willow, and the ethrog, which is a citron, are held together during the recital of prayers at the festival of Sukkoth. There is also an inscription "IOCIN," which may be the name of the original owner of the ring.

PAUL DENIS

▶In the 1930s and the 1940s Peter Marshall Pringle (1878–1953) toiled as a diligent archaeological recorder in southwestern Ontario, on what he called his Grand River Project. He made notes and drew maps of sites based on on his own observations and the first-hand accounts of local collectors, which he compiled in his "museum on paper." He also amassed a sizeable collection of artifacts. During his

lifetime he gave some of his museum on paper to the ROM. Recently, his nephews, Alan and Peter Pringle, donated the remainder of his documents and his collection to the Department of New World Archaeology. The donation, which consists of hand-coloured site maps and almost 2000 artifacts dating from 8000 B.C. to A.D. 1500, is an important addition to the Museum's collection from the lower Grand River.

MIMA KAPCHES

BILL ROBERTSON

▶It is exceedingly rare to find colour patterns on trilobite fossils. Three recently acquired specimens of *Phacops rana* found in 365-million-year-old rocks near Alden, New York, have hundreds of small black spots arranged symmetrically along both sides of their thorax and around their eyes. The original colour of the spots is unknown because trilobites have been extinct for more than 200 million years. Presumably, like those on a leopard skin, the spots provided camouflage. Those on the head probably helped to disguise the prominent bulbous eyes with their many facets. The eyes are also remarkable because they have lenses of transparent crystalline calcite connected to fibres running to the "brain," which have been interpreted to be light guides—fibre optics dating from 365 million years ago.

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The Bat Cave

The St. Clair Cave is a three-kilometre-long subterranean cavern in the middle of Jamaica that is home to millions of bats, as well as spiders, crabs, wild cats, snakes, and many other animals. The shape, surface, texture, and ecology of areas in the real cave have been vividly reproduced at the ROM in the new Bat Cave. As visitors tour the Bat Cave, three thousand bats appear to fly through the air.

Four years of work were necessary to complete the Bat Cave. During two ROM expeditions to Jamaica and the St. Clair Cave our scientists and artists collected specimens of plants and animals, shot photos, and created scale drawings—the reference materials needed for designing the cave. Many complex procedures were then required for its construction and others for its operation. The moulds used to make the bats' torsos were taken from freeze-dried specimens and each bat, made of vinyl and wax, was carefully assembled by hand. Tons of plaster was sculpted over steel and metal lath to recreate the site's physical features. A large painted mural dramatically reproduces the forbidding entrance to the St. Clair Cave, a fifty-foot-sinkhole full of rocks, vegetation, and giant tree roots. Ingeniously programmed strobe lights and mirrors are used to simulate the evening flight of thousands of bats from the cave. Recorded sounds from the St. Clair Cave, such as authentic bat calls, can be constantly heard.

Not only does the Bat Cave amaze and delight visitors, it also informs them about cave formation, the ecology of such an environment, and the seven species of bats introduced during the cave tour. A guide installed at the entrance to the cave provides introductory information to the species' size and range of habitats, and a series of colourful cartoons dispels some myths about these much-maligned mammals.

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have just seen and about some of the other nine hundred known species. A display entitled Discovering Bats illustrates the astonishing variety of bat families and the flight and feeding habits of different bats.

The opening of the bat exhibits has enabled the ROM, for the first time, to place more than one or two specimens from the bat collection on permanent display. There are now more than thirty-five thousand bat specimens from around the world in our collection.

The Hardwood Forest

The new Hardwood Forest Gallery is a realistic portrayal of a forest in Haliburton, Ontario. It is the ROM's largest diorama of a natural environment. Eighteen trees, with forty thousand leaves, are so true to nature that it is often difficult to distinguish the ROM vegetation from the real specimens that are included in the display.

The trees were created by taking latex moulds of real tree trunks and branches and then making fibreglass reproductions. Fabric leaves and pine needles of synthetic brush bristles were painted and individually affixed to the branches. Visitors to the gallery will also see more than twenty animals, including four deer pausing by a brook, a flying squirrel peering out from a tree, and a porcupine poised on a branch under a canopy of fall leaves.

Diagrams and text explain the energy pathway from sunlight, to trees and shrubs, to herbivores, and finally to carnivores in this ecosystem. Interesting facts about the animals' habitat, breeding, and eating habits are also noted. Today most of the trees in the Haliburton forest are hardwood—maple, aspen, oak, and birch—but originally there was a mix of hardwood and softwood trees. Logging operations in the 19th century cleared the huge softwood pines. A lone white pine in the corner of the ROM forest is a blunt reminder of this loss.

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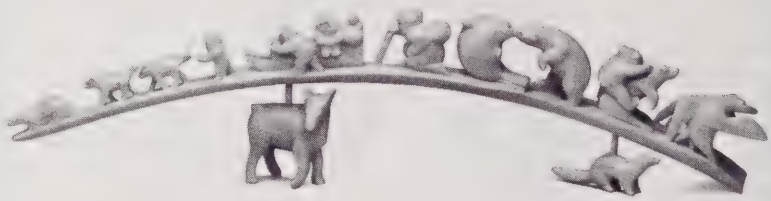

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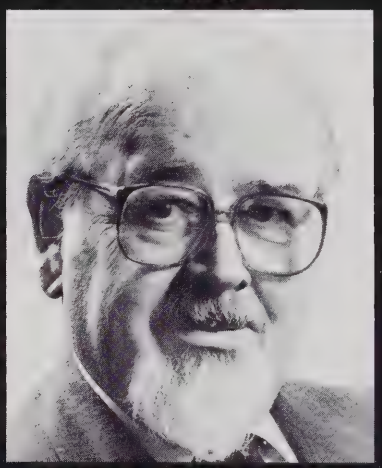

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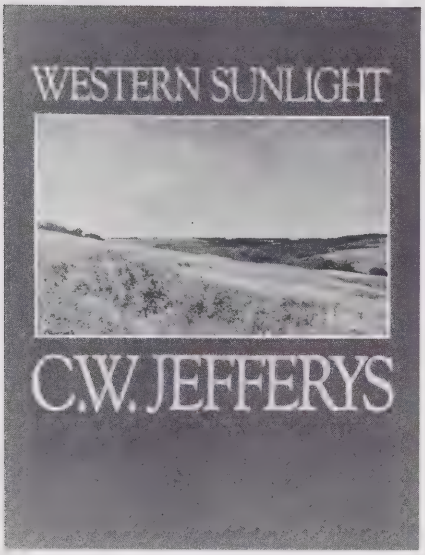

Western Sunlight: C. W. Jefferys on the Canadian Prairies
Robert Stacey
Mendel Art Gallery
104 pp. $12.00 (paper)

Reviewed by Christopher Varley, a Toronto-based art dealer and art historian specializing in Canadian art

C. W. Jefferys (1869–1951) is most widely remembered as the historical illustrator who rendered *everything* from farm implements to Simon Fraser's past. The depth and breadth of his research was astounding, and while his *magnum opus*, the three-volume *Picture Gallery of Canadian History,* now looks about as quaint as the material illustrated, it remains a valuable reference four decades after publication.

Jefferys' paintings have not fared as well. His surviving murals of subjects drawn from Canadian history look stale, and while he was a talented watercolourist with a fine eye for light and colour, he was so self-effacing in the presence of nature that many of these more intimate works look rather boring and undistinguished today. They lack, as Gauguin once unwisely said of Van Gogh, "the sound of the trumpet"—the immediate impact that we have come to expect from modern painting.

But there is a happy exception to this general rule, for in 1901 Jefferys made the first of six trips to the Canadian prairies, where he discovered a landscape so spare and understated that it seemed to mesh perfectly with his own temperament and artistic leanings. And while it was not until his second trip of 1906 that he was able to make anything of this spacious light-filled subject (so different from the landscape that he knew around Toronto), the canvases that he produced over the next few years are of such manifest quality that they have ensured a permanent place for Jefferys in the annals of Canadian art.

The finest of these are a handful of large landscapes produced after an extended visit to the Qu'Appelle

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Valley north of Regina in 1911. These epic views were the first to accurately render the subtle, seductive beauty of prairie summers, with their clear light and tawny grasslands accented with touches of violet and blue. And they speak of Jefferys' own happiness and contentment at the time. For once, he seemed to toil without tiring, freed of the stodgy didacticism that was so much a part of his character.

The importance of these few large paintings was soon recognized; the National Gallery of Canada purchased *Western Sunlight, Last Mountain Lake* in 1911, the year of its execution, and the Canadian National Exhibition Association placed *A Prairie Trail ("Scherzo")* on loan to the Art Gallery of Toronto in 1913. While they were later overshadowed by the wilderness landscapes of the Group of Seven, they certainly never fell into disfavour. If they seemed neglected, it was simply because there were so few of them. Great reputations are rarely built on such a small body of work.

This brings me to Robert Stacey's catalogue *Western Sunlight: C. W. Jefferys on the Canadian Prairies,* which was published two years after the exhibition that he organized for the Mendel Art Gallery in Saskatoon. It includes his fifth extended essay on Jefferys, and while it benefits from being more tightly focused than some of the others, it also suffers from a repeated flaw: Stacey's insistence on portraying his grandfather as a forgotten underdog. Not only is this an inaccurate portrayal, it always sounds like a re-hash of the complaints of those artists who resented the success of the Group of Seven. "We did it first," they insisted after the fact, often with little more than their friends' support as evidence.

According to Stacey, Jefferys has not been given enough credit for all sorts of things, including his efforts to develop a "North American style and technique" and his pioneering role as interpreter of the supposedly unpaintable Canadian prairies. But what else is new? Surely Jefferys has actually fared better than his contemporaries, most of whom were simply washed away when the Group of Seven, with its nationalism and glamorous modernity, stormed the beaches. Whatever happened, for example, to Jefferys' mentors and associates W. W. Alexander, F. H. Brigden, C. M. Manly, and G. A. Reid? I wish that Stacey would devote some of his time and talent to them, and to the other members of that lost generation of Canadian painters.

This criticism aside, *Western Sunlight* provides a wealth of new visual information in an attractive format. Everything in the 1984 exhibition appears in crisp black and white or excellent colour reproductions. The large number of small, annotated pencil drawings are interesting for browsing and they form a solid base for further research. When Stacey distinguishes the forest from the trees, he is one of the finest and certainly one of the most resourceful art historians in this country.

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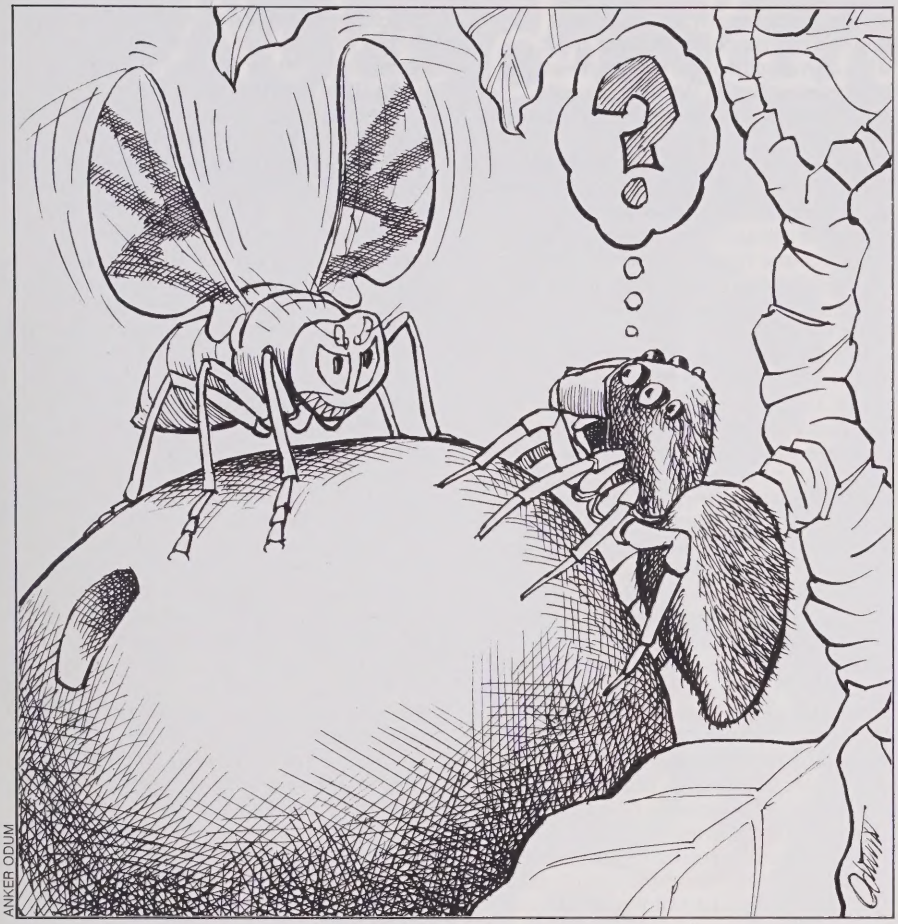

ANKER ODUM

How do you like them apples?

1. Of many famous apples, the one that Isaac Newton observed had the most profound effects on civilization since the apple in Eden. Two questions: is it true that the fall of an apple inspired Isaac Newton to great thoughts, and what exactly were those thoughts?

2. The state of Washington produces nearly fifty per cent of all the apples grown in the United States, but it was the employees of a famous Canadian company that first brought the apple seeds to Washington. What is the name of the company?

3. Benjamin Thompson, Count Rumford was an odd but brilliant scientist. In 1798, while Thompson was watching cannon being bored, he realized that the heat being produced was the result of the motion of the drill, and that heat was really just another form of motion. At about the same time, one of Thompson's cousins was becoming part of a newly created and great North American apple legend. Who was Thompson's cousin?

4. The apple maggot is a serious pest to apples. It is the larval form of an interesting species of fruit fly that employs mimicry to escape death at the hands (claws) of jumping spiders. The flies display stripes on their wings in order to resemble . . . what?

5. One of the most famous European legends with an apple at its core is thought to have been derived from earlier versions that featured writing-tablets or even hazelnuts instead of apples. What is the legend?

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ROTUNDA QUIZ

1. Yes, it's generally accepted that Newton did indeed watch an apple fall—although not on his head—in the family farmyard in Woolsthorpe, in 1665 or 1666. Newton told the story to two or three of his acquaintances—but much later, when he was in his eighties.

The falling apple is supposed to have made Newton wonder whether the force that attracted the apple to earth was the same force that held the moon in its orbit. A profound leap, to say the least, and Newton was only twenty-four at the time.

Incidentally, the tree survived only until 1820, when it was felled in a storm. Luckily, scions (twigs for grafting) had been taken from the tree, and there are now apple trees in Britain and in the United States that bear the same kind of fruit that inspired Newton's gravitational thoughts. The apple is reputed to taste terrible; the variety is called the Flower of Kent.

2. The Hudson's Bay Company. The story varies slightly depending on the source, but either a romantic young woman or a group of women plays the key role. A lunch party was given in London, England, in 1825 to honour the young men whom the Hudson's Bay Company was sending out to Fort Vancouver in the wilds of the Pacific Northwest. (This is now, of course, Vancouver, Washington.) Depending on the version, a young woman slipped some seeds from the apples eaten at this party into the waistcoat pocket of Captain Simpson or several young women slipped seeds into the pockets of several young men. I prefer the Captain Simpson version because in one account the young woman is described as "imploring" Simpson to plant the seeds upon his arrival at the fort. At any rate, the seeds were given to the Scottish gardener at Fort Vancouver, whose name has come down to us as Bruce. And one of those trees still stands in Vancouver, Washington.

3. John Chapman, better known as Johnny Appleseed. John's mother, Elizabeth, was Count Rumford's cousin. The legend of Johnny Appleseed appears to be pretty accurate. He did wander through Pennsylvania, Ohio, Indiana, and as far west as Iowa, through the early 1800s. And he did plant orchard after orchard of apple trees, always moving just ahead of the waves of westward migration. He's commonly depicted as being barefoot (true), with tattered clothes and odd hats—even a tin pot (apparently true as well). Johnny wandered freely through frontier country (Indians left him alone), planting apples trees and preaching the word of Emanuel Swedenborg. Chapman was supposed to be a great woodchopper and capable of walking barefoot on ice for kilometres. It is also said that he once rafted down a river on a cake of ice. But there's no evidence, as has been suggested, that he walked as far as the foothills of the Rockies.

4. The jumping spiders themselves. Dr. Bernard Roitberg of Simon Fraser University claims this is the first example discovered of a prey animal mimicking its attacker. If the fruit fly holds its wings away from its body and waves them up and down, the stripes on the wings give the impression of the aggressive leg-waving behaviour of the spider. The fly also jumps up and down, and all of this seems to persuade the spider that it is looking at a rival, not dinner. Dr. Roitberg determined that spiders fled from flies performing this act in the same way they fled from other spiders.

Another experimenter tried gluing house-fly wings, which are stripeless, onto one of the fruit flies. Sad to say, although it waved its transparent wings frantically, the fly couldn't deter the spider. Funnily enough, neither could the reverse transplant recipient, a house fly with fruit-fly wings. What the house fly had gained in equipment, it lacked in technique. It held its striped wings at the wrong angle, and the spider didn't hesitate to attack.

5. The legend of William Tell. The story goes as follows: Tell was a peasant from a village called Burglen, and one day when he journeyed to Altdorf with his son, he came across a stake with a hat on it in the main square. It had been put there by the Austrian governor Gessler to symbolize Austria's sovereign power. Everyone who passed by was to bow before the stake, but Tell refused. Gessler wasn't pleased by this, and demanded as punishment that Tell shoot an apple placed on the head of Tell's son. Tell of course did it (either with bow and arrow or crossbow) and eventually killed Gessler himself.

Most historians view the Tell story as a kind of Swiss Robin Hood legend: there may have been someone like him, but there seemed to be no records of a William Tell. More to the point, there are other stories that bear more than a passing resemblance to the one about Tell. For example, a Dane, named Toki, living in the 1st century A.D., was also challenged to shoot an apple from his son's head. Toki gave his son one good piece of advice ("Don't move"), and split the apple. Then there was King Olaf of Norway who challenged a heathen named Eindridi to shoot a writing-tablet off HIS own son's head. And another Norseman, Hemingr, was challenged by the famous King Harold (of the Battle of Hastings) to shoot a hazelnut off his brother's head. Interestingly, in all of these stories the marksman prepares two arrows—ready, in case he misses his mark with the first, to kill his challenger with the second.

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